

Comparison of Trip Attraction Between Malls and Schools in the City of Dagupan, Philippines

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Abstract: This study aimed to compare the trip attraction, their characteristics and behavior, among selected shopping malls and selected schools in Dagupan City. Descriptive and basic statistical analyses were used to analyze the data including use of EMME software to simulate the trip generation/attraction among the schools and shopping malls. This paper is conceptualized based on the observation that traffic congestion is one of the common transportation problems encountered by developing cities in the Philippines where Dagupan City is not an exemption. Dagupan City is a commercial hub north of Manila and a center of education in the region. Shopping malls and schools in the City of Dagupan are observed to be the major trip generators in the city that have significant impact on road congestion. The salient findings of the study showed jeepney and tricycle are the common mode of choice used by majority of commuters going to school and mall. The results also showed that vehicle volume and pedestrian counts attracted to the school and the mall have different peak periods. This finding will have some implication when introducing travel demand management schemes to the city.

Keywords: Road Congestion, Trip Attraction, Shopping Trips, School Trips

1. INTRODUCTION

Traffic congestion is a common problem encountered not only by highly urbanized cities but also by developing cities. Studies show that there are a lot of factors that causes traffic congestion where this may include poor traffic signal timing, weather events, and road accidents. Consequently, the more evident cause of traffic congestion in the city of Dagupan is due to trip attraction generated by shopping malls and schools. Traffic congestion is further evident where the shopping malls and schools are located within the periphery of the central business district.

Traffic congestion is a challenging problem to a growing city. The impact of traffic congestion problems to economic activity of the city is a serious concern for local transportation planners because this may translate to economic losses. Potential investors may be discouraged if these traffic congestions problems are left unsolved. With the advent of economic growth in the city of Dagupan, it is observed that the problems on traffic congestions are slowly evident.

Dagupan City is a developing city which is located approximately 212 kilometers north of Manila. The city is not exempted on the repulsive sight of traffic congestion. The local government places traffic congestion problem as one of its top concern looking for best approaches to solve the problem. New traffic management schemes have been implemented, designation of strategic loading and unloading zones for public utility vehicles were introduced, including installation of intersection traffic lights.

One of the contributory factors of trips attracted to shopping malls and schools is the population itself of Dagupan City as well as that of the Province of Pangasinan. Dagupan city has a population of 171,271 based on the 2015 census of the Philippines. The province of Pangasinan on the other hand is the 4th most populated province in the Philippines with a total population of 2.96 million. Four municipalities and three cities of Pangasinan are even recognized as one of the ten most populated areas in the region (<https://psa.gov.ph/content/highlights-philippine-population-2015-census-population>).

The city's growth is not only in terms of increase in population but also in its economic growth. Dagupan city became a viable choice of trip destination since it is the commercial hub in the province. One of the city's recent milestones is the recognition it obtained as the next wave cities in the Philippines. The city's strategic location in Northern Luzon and the presence of educational institutions that provide abundant talent for the different skills needed by industries made Dagupan City as a viable destination for investments in the sectors of Information Technology and Business Process (<http://dagupan.gov.ph/> 2016).

Aside from being the largest producer of the well-known tastiest milkfish (Bangus) in the world, the city of Dagupan positioned itself as the destination of choice for business investment. This is manifested with the coming of the largest chain of shopping mall in the Philippines. The economic growth of Dagupan City could also be attributed to its strategic location. The city is bounded by Lingayen Gulf in the north, San Fabian in the northeast, Mangaldan in the east, Calasiao in the south and Binmaley in the west (<https://en.wikipedia.org/wiki/Dagupan>).

The location of Dagupan City is seen to be at the heart of Pangasinan's big municipalities. The city is considered as the province's industrial hub. It is a subregional center for trade and commerce, finance, high-level health and education services of Region 1 in Northern Luzon.

Consequently, with the sprout of shopping malls and schools in the city of Dagupan, traffic congestion problems become apparent as these generate trips from/to these establishments and intitutions. Traffic problems relating to road congestion become a challenge to the city as it continues to position itself as a business-friendly city North of Manila.

1.1 Trip Attraction in the City

The major traffic generators in the City of Dagupan are observed both in the education and business sectors. The education sector has high impacts towards trip attraction in the city as there are three (3) big universities located in the heart of the city, twelve (12) colleges, and nine (9) vocational schools. In addition to these universities and colleges are the big secondary schools situated in the downtown loop of the city. With the presence of these educational institutions, Dagupan City is considered as a major contributor in producing graduates in the region.

The strategic location of Dagupan City results to attractiveness of business investments specially shopping malls. Most of the malls are located within the central business area thus contributing significantly to the increase of vehicle volume in these areas. There are two big shopping malls that are not located in the central business area but its impact to traffic volume is also a major concern

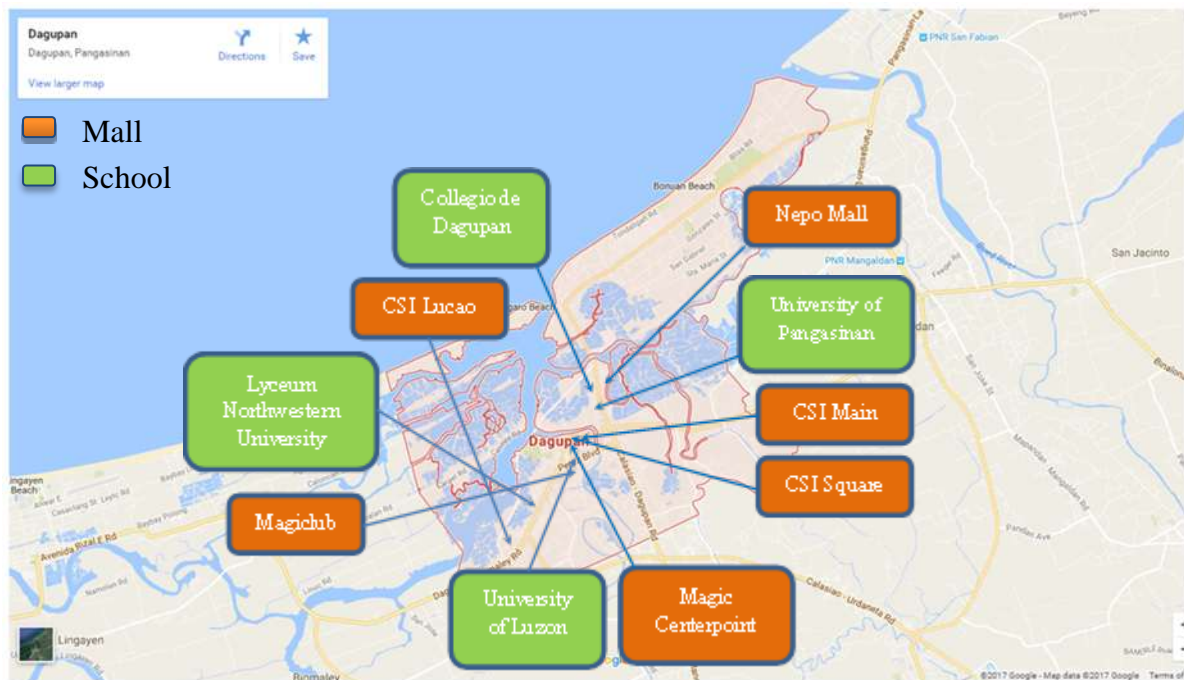


Figure 1. Location map of selected malls and schools in Dagupan City

Figure 1 shows the location of selected shopping malls and schools in Dagupan City. It is observed that the schools and shopping malls in the city are major contributor to trip attraction in the city that often times during their peak hours contribute to road congestions in their specific zones. Thus, this study is conceived with the aim to compare the trip attraction, their characteristics and behavior among selected malls and schools located in the city of Dagupan.

1.2 Objectives

The main object of this study is to compare the trip attraction among the schools and malls in the city. The specific objectives of this study are the following:

1. determine the urban travel characteristics of the pedestrian generated by the school and the shopping mall in the city, and
2. to quantify the trips attracted, in terms of both pedestrians and vehicles, to the school and to the mall.

2. LITERATURE REVIEW

This section presents similar studies that are focused in trip attraction and generation. Studies relating to impact of trip attraction to traffic congestions are also presented to understand the implications of trip attraction generated by schools and malls in the city of Dagupan.

The study of Russo and Comi (2012) entitled “The simulation of shopping trips at urban scale: Attraction macro-model” presents advancement on the calibration of model systems to estimate the goods attracted within urban and metropolitan areas. The study

developed a general modelling framework where the primary characteristic is the representation of interacting behavior of commodity consumers and commodity suppliers. Amavi et. al (2014) on the other hand conducted a study on advanced trip generation/attraction models. The study used the multiple linear regression (MLR) model from zonal data where the models were compared to each other by analyzing their hypothesis and the required adjustments. The model considered the spatial correlation and analyzed their improvements with reference to previous models not considering spatial correlations.

The study of Kulpa and Szarata (2016) is focused on analysis of household survey sample size in trip modelling process. The Comprehensive Travel Surveys (CTS) were conducted where the core part of the survey are the household trip questionnaires used to identify residents' trip pattern. The present study on the other hand used home interview survey to identify the trip characteristics of pedestrians going to schools and malls in the city of Dagupan.

The following studies are focused on transport assessment and road congestion which is an emerging problem in the city of Dagupan. The study of Nemchinov (2016), assessed the sufficiency of road network with different functional classification development as determined by the demand for transport services, which is characterized by the peak hours volumes. Jain et. al (2016) focused on predicting susceptibility to user-demand responsive transport using demographic and trip characteristics of the population. The study emphasized the demand patterns that are caused by the spatial variation of demographic characteristics, and travel behavior over the city.

Congestion indicators on the other hand are classified by Oliveira, et. al (2014) into three main groups: 1) Balance between supply and demand – indicators that assess congestion based on the impairment of the traffic flow capacity of the link under analysis; 2) Velocity and time – indicators that evaluate the trip flow in terms of average speed (or its variation) or average time (or its variation); and 3) Others – indicators that cannot be classified in the above two groups.

Takayama (2015) emphasize urban traffic congestion as caused by concentrated demand for travel around the start of the workday, because firms in central business districts (CBDs) generally have fixed work schedules and workers start work at the same time. Toledo (2011) stressed that road traffic congestion produces undesirable impacts on urban city centres. Delays and air pollution are well known negative examples of these impacts and several policies have endeavored to reduce them.

3. THEORETICAL FRAMEWORK

To analyze the trip attraction between schools and shopping malls, the classical four-step model was used. The four-step process involves trip generation, trip distribution, mode choice, and traffic assignment (Graber & Hoel, 2012). This study focused on the first step which is the trip generation with the aim to determine the number of trips generated by the shopping mall and the school. Figure 2 shows the four-step model.

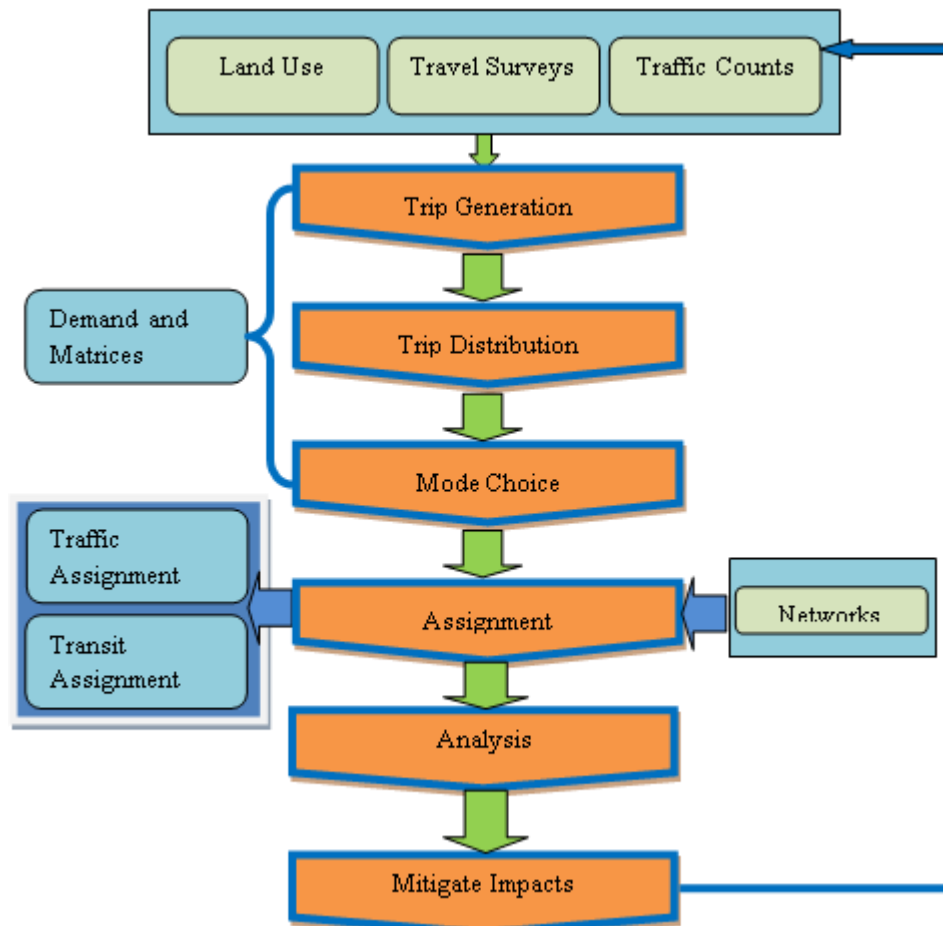


Figure 2. The Four-step transportation planning model

4. RESEARCH METHOD

This study used descriptive type of method of research. It is descriptive because it attempts to describe the travel demand generated by the school and shopping malls in the city of Dagupan.

4.1 Sources of Data

The data, both secondary and primary, used in this study include the following:

1. Road network map of Dagupan City. Documentary analysis using the data from Land Transportation Office (LTO) was used and interview with the different public and private commuters and operators were conducted.
3. Vehicles volume count. Vehicles entering and exiting the mall and the school were counted. It includes both the public and private means of transportation. The vehicle count for the school started at 6:30 AM in the morning up to 6:30 PM in the evening while the shopping mall started at 9:00 AM in the morning to 6:30 PM in the evening.
4. Pedestrian count. Pedestrian count includes the students and employees entering and exiting the school. For the shopping mall, customers and staffs entering and exiting the mall were included. The pedestrian count for the school started at 6:30 AM in the morning to 6:30

PM in the afternoon while the shopping mall started at 9:00 AM in the morning to 6:30 PM in the afternoon.

4.2 Research Design

Figure 3 shows the research design used in the study. Pedestrian and vehicle counts of the school and the mall were conducted. These data are used to compare the trip characteristics of the school and the mall.

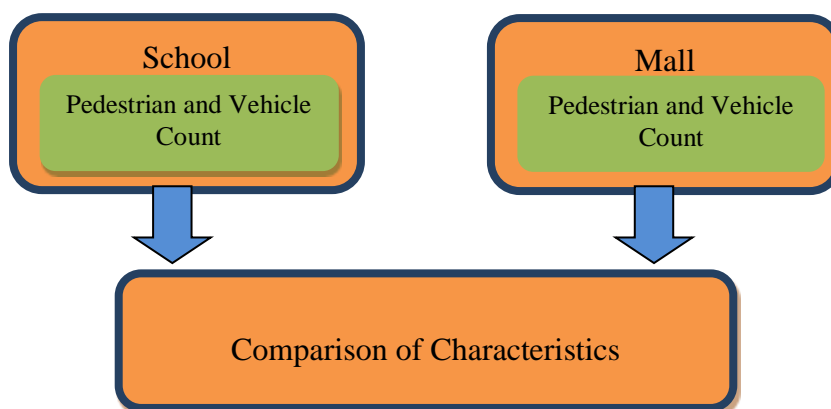


Figure 3. Research design

5. RESULTS AND DISCUSSION

This section presents the findings, analysis and interpretation of the data gathered to answer to the stated problems of this study.

5.1 Traffic Volume Characteristics in the Vicinity of the Schools and Malls.

Table 1 shows the volume count on the pedestrian and the vehicle volume passing along the school zone. It can be noted that the peak period for the pedestrian entering to both school is found at 7:30-8:30 in the morning. Also, the peak period during the afternoon is the same for both school and this is observed at 12:30-1:30 PM. The same is observed for the pedestrian exiting the school where peak periods are found at 11:30-12:30 for the morning sessions and 4:30-5:30 for the afternoon sessions. The peak periods of pedestrians entering the school campus for both schools could be attributed to the fact that classes usually starts from 7:30 to 8:00 o'clock in the morning. The same could be deduced for the pedestrian leaving the campus since classes on these universities usually ends from 4:30 to 5:30 PM.

Table 1. Pedestrian and Vehicle Volume Count of the School

	UPang				LNU			
	Morning		Afternoon		Morning		Afternoon	
	Peak Hour	Volume	Peak Hour	Volume	Peak Hour	Volume	Peak Hour	Volume
Pedestrian School Entry	7:30-8:30	2271	12:30-1:30	1701	7:30-8:30	1368	12:30-1:30	1132
Pedestrian School Exit	11:30-12:30	4355	4:30-5:30	3707	11:30-12:30	1039	4:30-5:30	1071
Vehicle Uptown Direction	7:30-8:30	1299	5:30-6:30	1156	7:30-8:30	946	4:30-5:30	1013
Vehicle Downtown Direction	7:30-8:30	1423	4:30-5:30	1166	7:30-8:30	1382	3:30-4:30	1147
Vehicle Campus Entry	7:30-8:30	72	2:30-3:30	53	7:30-8:30	314	4:30-5:30	100
Vehicle Campus Exit	7:30-8:30	38	2:30-3:30	59	7:30-8:30	205	4:30-5:30	186

The uptown and downtown directions were considered in the vehicle volume count passing along the school area. The table shows that the uptown directions have the same peak period for both schools during the morning but there is a slight change during the afternoon period. The peak hour for vehicle volume on the uptown direction is found at 7:30 to 8:30 AM for both schools, while the afternoon peak period is found at 5:30-6:30 PM along University of Pangasinan while the other school is found at 4:30 to 5:30 PM.

The peak period for vehicles entering and exiting the campus is again similar for both school and is observed during the 7:30 to 8:30 AM periods respectively. The peak hour for the afternoon session on the other hand reveals different intervals for the schools. The peak hour period for University of Pangasinan is at 2:30 to 3:30 while the other school is at 4:30 to 5:30. The same peak hour periods are reflected for the vehicle leaving the school campus.

Table 2 on the next page shows the volume count of the pedestrian and the vehicle volume count passing along the shopping mall areas. It can be noted that the peak period for the pedestrians entering to both malls is found at 11:30-12:30 in the morning. On the other hand the peak period during the afternoon is found at 12:30 to 1:30 for Nepo Mall while Magic Centerpoint is at 4:30 to 5:30 periods. Exit of pedestrians from the mall is found at 11:30 to 12:30 PM for both malls during the morning, but different peak hours are observed during the afternoon period. The exit of pedestrian during the afternoon period is found at 5:30 to 6:30 for the Nepo Mall area while Magic Centerpoint is at 4:30 to 5:30 periods.

The peak periods for vehicle volume on the uptown directions show slight difference during the morning intervals but the same peak hours is noted during the afternoon periods. The peak hour is found at 11:30 to 12:30 AM for both malls during the morning intervals but the afternoon periods shows Nepo mall has peak hour at 4:30 to 5:30 but Magic Centerpoint is found at 4:30 to 5:30 PM.

The peak hour period for vehicle volume on the downtown directions are found at 8:30 to 9:30 AM for Nepo Mall while Magic Centerpoint is at 11:30 to 12:30. The afternoon peak periods on the hand are the same for both malls.

Table 2. Pedestrian and Vehicle Volume Count of the Malls

	Nepo Mall				Magic Centerpoint			
	Morning		Afternoon		Morning		Afternoon	
	Peak Hour	Volume	Peak Hour	Volume	Peak Hour	Volume	Peak Hour	Volume
Pedestrian Mall Entry	11:30-12:30	1702	12:30-1:30	1679	11:30-12:30	941	4:30-5:30	1164
Pedestrian Mall Exit	11:30-12:30	1278	5:30-6:30	1823	11:30-12:30	809	4:30-5:30	758
Vehicle Uptown Direction	10:30-11:30	682	4:30-5:30	854	11:30-12:30	895	4:30-5:30	768
Vehicle Downtown Direction	8:30-9:30	1003	2:30-3:30	1029	11:30-12:30	445	4:30-5:30	433
Vehicle Mall Entry	11:30-12:30	384	4:30-5:30	424	-	-	-	-
Vehicle Mall Exit	11:30-12:30	301	4:30-5:30	374	-	-	-	-

5.2 Descriptive Statistics of Respondents

Table 3 shows the comparison of the personal and trip characteristics of respondents going to the mall and the school. The mean age of pedestrians going to malls is 23 with standard deviation of 8.17 while the mean age for the school is 21 with standard deviation of 7.70. The pedestrian count for the mall shows 56% of the mall goers are female while for the school, 51% are females.

On the educational attainment, 32% of the mall goers are college student and 24% are college graduate. Majority of the respondents in the school on the other hand are college students with a percentage of 79.7%. The average monthly income of respondents going to malls is 9,951.10 pesos which is higher than the average monthly allowances of respondents going to school which is only 4,270 pesos.

To determine the mode of transportation frequently used by the respondents, the Likert scale is used with the following descriptive interpretation: 0 to 1.5 is “Always”; 1.5 to 2.5 is “Very Often”; 2.5 to 3.5 is “Sometimes”; 3.5 to 4.5 is “Rarely”; and 4.5 to 5 is “Never”. For the malls, respondents use the following mode of transportation accordingly: Tricycle and Walking are “sometimes” used with mean value of 2.87 and 3.3 respectively. Jeepney is used “Very Often” with mean value of 1.75, while cars, bus, and motorcycles are used “Rarely”.

For the school, Tricycle and Bus are used “Sometimes” with mean values of 2.87 and 3.05 respectively. Jeepney is used “Very Often” with mean value of 1.30. Cars and Motorcycles are used “Rarely” with mean values of 3.98 and 3.70 respectively. This implies that most of the pedestrians going to malls and schools prefer jeepney as their mode of transportation.

Table 3. Descriptive statistics of respondents

	UPang	LNU	Nepo Mall	Magic Centerpoint
Mean Age	21	19	23	32
Sex:				
1. Male	248(47%)	197(44%)	210(45%)	89(43%)
2. Female	279(53%)	247(56%)	252(55%)	120(57%)
Educational Attainment				
1. Elementary	1(0.2%)	0	7(1.5%)	13(6.2%)
2. High School	25(4.7%)	43(9.7%)	110(23.8%)	59(28.3%)
3. Did Not Finish HS	2(0.4%)	0	10(2.2%)	4(1.9%)
4. College Student	420(79.7%)	381(86.2%)	145(31.4%)	47(22.5%)
5. Did Finish College	3(0.6%)	0	75(16.2%)	26(12.4%)
6. College Graduate	73(13.9%)	10(2.3%)	110(23.8%)	55(26.3%)
7. Master/PhD	3(0.6%)	8(1.8%)	5(1.1%)	5(2.4%)
Mode of Transportation:				
1. Private Car	57%(Sometimes)	47%(Sometime)	52%(Never)	57%(Never)
2. Bus	46%(Never)	44%(Never)	46%(Never)	59%(Never)
3. Jeepney	29%(Always)	33%(Always)	60%(Always)	38%(Always)
4. Tricycle	57%(Always)	46%(Alway)	29%(Sometimes)	50%(Always)
5. Motorcycle	29%(Always)	49%(Never)	44%(Never)	46%(Never)

5.3 Origin-Destination Bar Chart Using EMME Application.

Figure 4 shows the origin-destination bar chart generated by the schools and shopping malls. It could be noted that trip attraction generated by the schools and shopping malls are originating from the neighboring towns of Dagupan City. The origin-destination bar chart affirms the strategic position of Dagupan City as the central hub for commerce and also as the center for education in the province.

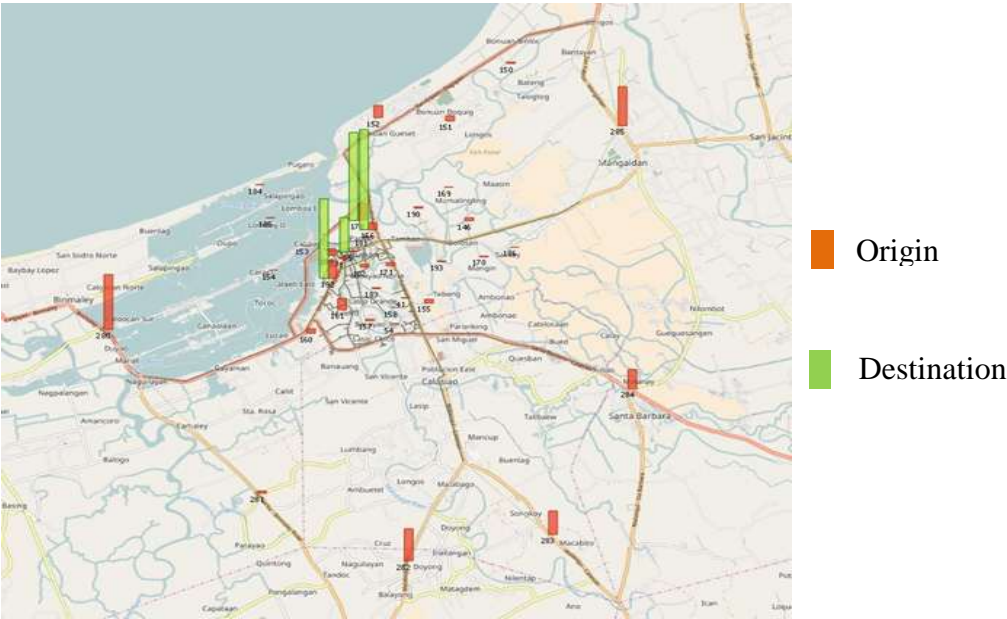


Figure 4. Origin-Destination matrix histogram of schools and malls observed

5.4 Comparison of Trip Characteristics and Behavior Between Schools and Shopping Malls

Figure 5 shows the characteristics of pedestrians entering the shopping malls and to the school. It could be noted that more females are entering the school premise and the same is observed for the shopping malls.

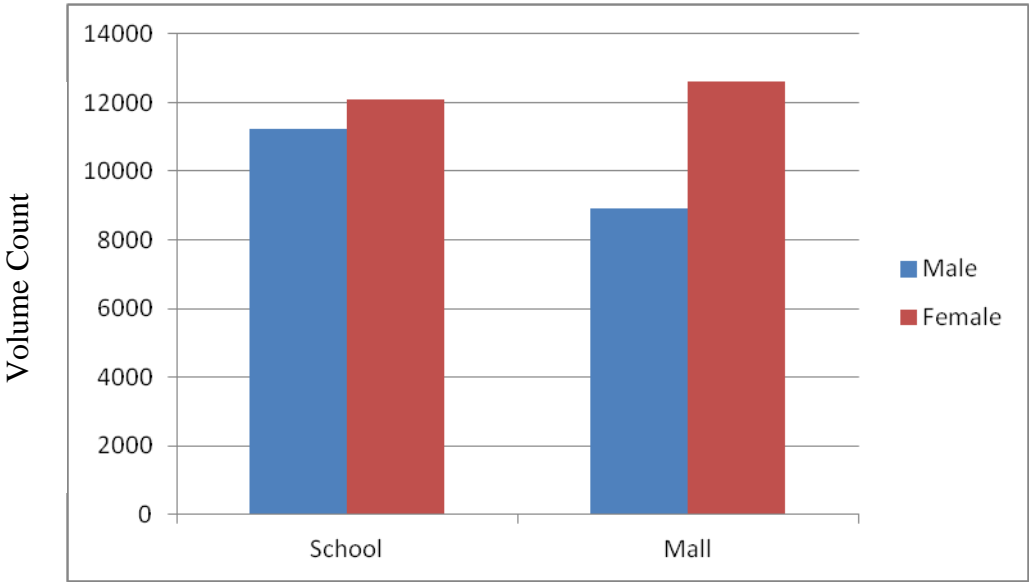


Figure 5. Pedestrian Volume Count According to Gender

Figure 6 shows the combined volume count among the selected schools and shopping malls in Dagupan City. It can be observed that the peak hour for the school and mall are entirely unique which could be attributed to the fact that the opening hours of the mall is different

with the opening hours of schools. The figure shows an earlier peak period for the school while the mall peak period is found during the later hours.

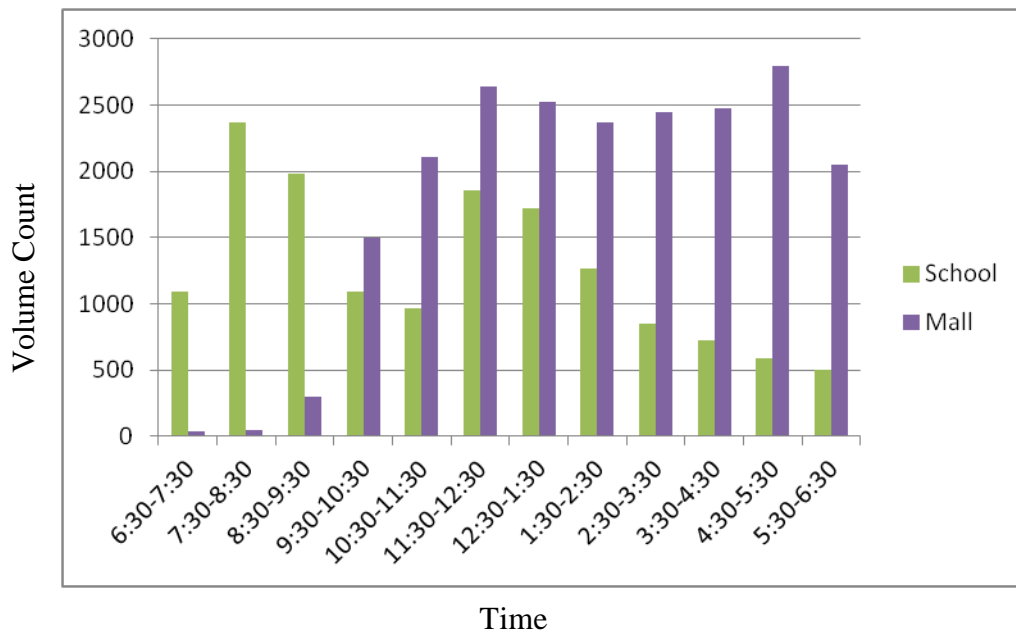


Figure 6. Pedestrian Volume Count of Schools and Shopping Malls by Hour of Day

6. CONCLUSIONS

The following conclusions could be drawn given the findings of this study:

1. Peak hour volume of vehicles passing the roads in the vicinity of the mall and the school happen at different time periods and directions of flow. Hence, should be considered when introducing traffic management schemes like the introduction of traffic intersection signalization in the city.
2. Similarly, the peak hour of pedestrian flows entering and exiting the gates occur differently for the school and the mall. These are however predictable since this usually coincides with the starting time or dismissal of classes for the school and the opening of the mall.
3. Pedestrian volumes for the mall are greater than the pedestrian volumes going to school. In a day, more females enter the mall or the school than males.
4. The jeepney mode is the mode of choice of majority of those going to school and mall in the city.
5. Lastly, the results of this study will further serve as reference for future studies involving trip attractions.

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