

Assessment of Public Transport Demand and Supply Characteristics for the UP Campus-Katipunan Route

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Abstract: The main objective of this study is to determine the total passenger demand which includes served and unserved passenger demands of the UP Campus-Katipunan jeepney route which involves two transport lines (Katipunan-UP Campus and Katipunan-Balara); and to calculate the required number of jeepneys and compare it to the actual unit supply for both operating lines. The served passenger demand is obtained by analyzing data obtained from transport surveys namely – Boarding and Alighting Survey and License Plate Survey while the unserved demand is calculated by sensitivity analysis wherein the unserved demand is estimated as a percentage of the total demand. The calculation of the required number of jeepney units is based from the Route Measured Capacity Method. Another goal of this study is also to generate the desire lines of the UP-Katipunan route as obtained from the Origin-Destination Survey. From the findings of this study, it is concluded that both of the transport lines do not have enough units to satisfy the demand for a day. However, this will not be the case if only the number of roundtrips of each jeepney is increased or the number of jeepneys operating per day is increased.

1. INTRODUCTION

1.1 Background of the Study

One of the six (6) transport operating routes inside the UP Campus is the Katipunan – UP Campus transport route. Also included in the list are: SM North EDSA – UP Campus route, Philcoa – UP Campus route, Pantranco – UP Campus route, UP-IKOT route and UP-TOKI route. The Katipunan – UP Campus route is being served by two (2) transport lines. The first line (Katipunan – UP Campus) starts at the Katipunan terminal, passes around UP, and ends at Katipunan terminal. It has an approximated distance of 8.5 kilometers. The second line (Katipunan – Balara / Katipunan – UP Gate) starts from the Katipunan Terminal, passes beside UP along Katipunan Avenue and ends at Katipunan Terminal running at an approximate total roundtrip distance of 5 kilometers. Katipunan Terminal is located at the Intersection of Katipunan Avenue and Aurora Boulevard. Figure 1 shows the Katipunan Jeepney Route.



Figure 2. UP-Katipunan Jeepney Route

There are eighty (80) unique registered jeepney units for the first transport line. On the other hand, the second transport line has sixty-four (64) unique operating jeepney units. Typical passengers of the route consists of students, employees and residents of/near UP Diliman, Ateneo de Manila University, Miriam College and New Era University and employees of different establishments along Katipunan Avenue.

1.2 Objectives

The main objective of this study is to conduct a more extensive research to determine the passenger demand for the Katipunan – UP Campus line and assess if the current supply of eighty (80) jeepney units can satisfy it. This study takes into consideration the demand that is served by the second transport line (Katipunan – Balara).

The specific objectives of this study are as follows:

- Estimate the passenger demand for a day and specified peak hours for the Katipunan – UP Campus line
- Estimate the passenger demand for a day for the Katipunan – Balara line and determine its significance with respect to the Katipunan – UP Campus line
- Determine and compare the theoretical and actual number of jeepney units operating for a day for both transport lines
- Account the unserved demand in determining the number of units required for both transport lines
- Determine trip patterns of passengers using the transport route
- Compare with and verify the results of the previous study by Apilado and Perez

1.3 Significance of the Study

Though eighty (80) units seem to be a high number for supply, passengers still complain about its inadequacy, especially in peak hours. Operators are also seen to make their move in trying to increase registered units. Results of the assessment of the demand and supply of the transport lines can be used to determine if there is a need to add or reduce the number of registered units of either transport line or even help in the development and implementation of new transport schemes in improving the current condition of the transport routes.

1.4 Scope and Limitations

The scope and limitations of this study are listed as the following:

- a. The study area is from the Katipunan terminal to UP Campus and vice-versa.
- b. Data gathering involved public transport only, specifically the transport lines serving the Katipunan – UP Campus route.
- c. Occupancy of jeepneys was surveyed during peak hours to justify highest actual demand.
 - 7:00 AM – 9:00 AM for the morning peak hours
 - 11:00 AM – 1:00 PM for the noon peak hours, and
 - 4:00 PM – 6:00 PM for the afternoon peak hours
- d. The study is limited to the passenger demand during working days – Monday to Friday.
- e. Data processing and calculations were done manually with the help of computer softwares.
- f. It is assumed in the surveys that jeepney drivers load and unload at specified loading and unloading stations.
- g. The estimation of the unserved demand is limited by sensitivity analysis, where the unserved demand is expressed as percentage of the total passenger demand.

1.5 Framework

The conceptual framework for this study is given by Figure 2.

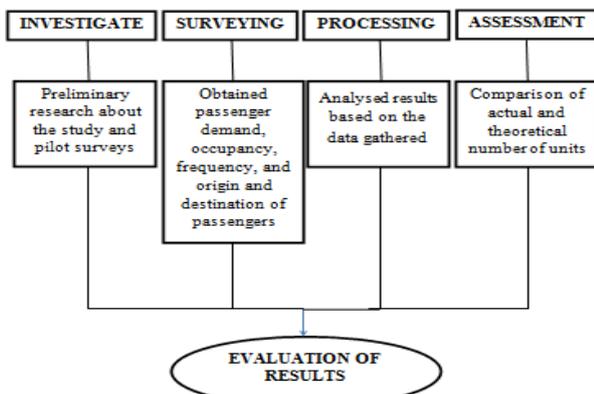


Figure 2. Conceptual Framework

1.6 Study Flow

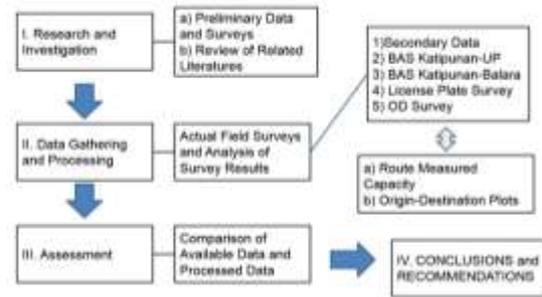


Figure 3. Study Flow

2. REVIEW OF RELATED LITERATURE

2.1 Boarding and Alighting Survey

Valdez (2011) used the survey in obtaining the occupancy of jeepneys to assess the public transport supply and demand characteristics for the UP Campus-North EDSA Route. Results of the study show that there is an oversupply of about 42.5% of the total supply.

Japan International Cooperation Agency (1984) used Boarding and Alighting survey in estimating the demand for public transport in Metro Manila. The objective of the survey in the study is to create a public transport database, as well as to provide a planning basis for rerouting the existing public transport route in view of implementation of LRT.

2.2 License Plate Survey

Apilado and Perez (2013) estimated the supply and demand of public transport of the six routes in UP Campus. The UP-Katipunan route is included in the study. However, the study is limited to the passenger demand catered only by the first transport line (Katipunan-UP). License Plate Survey was used in determining the frequency of public transport vehicles inside UP Campus. The survey was conducted for the two peak days of the week. Results of the study show that there is relatively enough supply of jeepneys that meets the demand.

2.3 Origin – Destination/Perception Survey

Apilado and Perez (2013) determined the trip patterns of passengers using Origin-Destination Survey. The study used the sample-size formula given by TRB. A zoning map was derived by integrating the existing zoning map of UP Diliman and Quezon City.

2.4 Route Measured Capacity

The Route Measured Capacity (RMC) is used to calculate the required number of vehicles to meet a given demand for a certain route. The Department of Transportation and Communication (DOTC) currently uses this method to estimate public transport supply. It

was first used in the 1980's to compute for the required public transport supply based on demand (Anaque and Landingin, 2012).

Mendoza and San Diego(2008) quantified the number of buses required to serve the demand of buses in EDSA using the Route Measured Capacity formula. It was compared to the actual supply of buses in EDSA and it was found out that there was an oversupply of 60%.

2.5 Viable Load Factor

The viable load factor gives the ratio of the demand and supply. It is ideally estimated using the costs, profit and fare rate of jeepney operations. However, due to frequent variations with these parameters, the viable load factor is usually assumed to be 60%.

Mendoza *et al.* (2008), Valdez (2011), Anaque *et al.* (2012), Apilado *et al.* (2013) used 0.6 as the viable load factor in their respective studies, assuming that Public Utility Vehicles are 60% full throughout their operation.

2.6 Sensitivity Analysis

A sensitivity analysis is used to include the unserved demand in the computation of the total demand using the RMC method. Unserved demand is expressed as a percentage of the total demand. Anaque and Landingin. (2012) used 0%, 3%, 5%, 7% and 10% while Valdez (2011) used 0-45% at 5% intervals for the analysis.

3. METHODOLOGY

3.1 Primary Data Collection

3.1.1 Boarding and Alighting Survey

Boarding and Alighting Survey was conducted to estimate the occupancy or the current passenger volume of jeepneys at different loading and unloading stations along the UP-Katipunan Route. Also, the average occupancy will be determined which will be used in the calculation of the passenger demand along the route.

In this survey, the surveyor initially rides a specific public transport vehicle at a specified starting point. In each station, the number of boarding and alighting passengers are counted and recorded. Once the vehicle has traversed the whole route, the surveyor rides another vehicle and repeats the process for the remaining time of the survey.

Two Boarding and Alighting Surveys were done – one for Katipunan-UP transport line and one for Katipunan-Balara transport line. The surveys were conducted during peak periods (7AM-9AM, 11AM-1PM, 4PM-6PM) and during working days (Monday – Friday). The desired number of trips (75) was

distributed to the fifteen periods throughout a week. For each period, the number of trips is 5. Survey dates were randomly chosen, depending on the availability of surveyors. For the first transport line, the survey was conducted from December 2013 to February 2014 while for the second transport line, the survey was conducted from February 2014 to March 2014.

3.1.2 License Plate Survey

License Plate Survey was conducted to obtain the frequency of Katipunan-UP jeepneys operating for a day. This data will be used in the estimation of the passenger demand for a day by expanding the average occupancy of each jeepney to one (1) day. Other data including number of roundtrips and utilization rate may also be obtained in this survey. The time a jeepney was observed was also recorded.

Surveyors were assigned stations wherein they recorded the body number of every Katipunan-UP Campus jeepney observed. The stations for the survey are the following: (1) Roces Gate, (2) UPIS. The stations in the survey are found along the route and not at the starting terminal to account the number of trip-cutting vehicles since there are reports that some jeepney drivers opt to not enter the Campus when there are few or no passengers left in their jeepneys before entering UP. This is not allowed since it affects the supply of jeepneys for the demand of passengers inside UP. In this survey, recorded vehicles at Station 2 that are not recorded in Station 1 are identified as trip-cutting vehicles.

The survey was conducted on February 17-21, 2014. To account the frequency of jeepneys for the whole day, the survey was conducted from 6am to 10pm since the entrance and exit gates of UP Campus are open only at this time period. Thus, drivers of the UP-Katipunan transport line only operate within this period.

3.1.3 Origin-Destination Survey

Origin-Destination Survey was conducted to determine the ultimate origins and destinations of passengers of UP-Katipunan transport line. The data gathering technique used was on-board interviews, wherein the passengers of the transport line were asked about their ultimate origins and destination. The survey was conducted on March 13, 2014, from 8am-5pm. The surveyor initially rode a Katipunan-UP Jeepney at Katipunan Terminal and interviewed on-board passengers until the Jeepney was back at Katipunan Terminal where the surveyor rode another jeepney. The process was repeated until the end of the survey period.

For the passengers of Katipunan-Balara transport line, it is desired to know the number of passengers coming from or going to UP Campus utilizing the transport line even there is another option for them, which is the Katipunan-UP transport line. The survey was conducted on March 13, 2014, from 7am to 8am and

from 5pm to 6pm. The chosen time periods are based on the assumption that these time periods are usually the start and end of classes and work. For the morning peak, the surveyor was stationed at Katipunan Terminal to account for passengers who were going to UP Campus. Before each jeepney was dispatched, the surveyor asked who among the passengers are going to UP and counted them. The number was then recorded. For the afternoon peak, the process was repeated but this time, the surveyor was stationed at Balara-Terminal to account for passengers who came from UP Campus.

3.2 Secondary Data

Each jeepney operating inside UP Campus is assigned with a body number by the Office of Community Relations (OCR) under the Office of Vice Chancellor for Community Affairs (OVCCA) for regulation and security purposes. The PUJ list was obtained from OCR because this can be used in verifying the license plate of operating jeepneys observed from License Plate Survey. The PUJ list contains the license plate of jeepneys and their corresponding body numbers.

Also, the seating capacities of jeepneys were surveyed separate from the License Plate Survey for simplification of the survey. The seating capacities of jeepneys were surveyed on February 11, 2014. The surveyors went to Katipunan Terminal and recorded the average seating capacities of jeepneys.

Aside from the seating capacity, operator interviews were also conducted for the Katipunan-Balara line to obtain the minimum and maximum number of roundtrips a jeepney can make. The total number unique jeepneys were also given by the operators.

3.3 Data Processing

3.3.1 Route Measured Capacity

The Route Measured Capacity (RMC) method is used to calculate the required number of Katipunan-UP and Katipunan-Balara Jeepneys to meet the passenger demand.

The formula for the Route Measured Capacity method is given by:

$$Nu = \frac{PD}{ASC * VLF * NRT * \mu} \quad (1)$$

Where:

- N_u - Required number of units
- PD - Passenger demand
- ASC - Average seating capacity
- VLF - Viable load factor
- NRT - Number of round trips
- μ - Utilization factor

Passenger Demand

The passenger demand is composed of the served passenger demand and the unserved passenger demand.

Served Passenger Demand

The formula for the served passenger demand is given by:

$$\text{Served Passenger Demand} = (\text{Ave. Frequency}) \times (\text{Ave. Occupancy}) \quad (2)$$

Average Occupancy

The occupancy of jeepney was obtained using the number of boarding and alighting passengers recorded in the Boarding and Alighting Survey. The occupancy of jeepney is given by the formula:

$$\text{Occupancy} = \text{Previous Occupancy} + B - A \quad (3)$$

Where:

- B = Number of boarding passengers
- A = Number of alighting passengers

The occupancy of each jeepney surveyed was averaged and the average occupancy of all jeepneys surveyed was obtained.

Unserved Passenger Demand

With the restriction of Boarding and Alighting Survey, the Route Measured Capacity only estimated the required number of units for the served demand. Sensitivity analysis was done in estimating the unserved demand.

Viable Load Factor

The viable load factor is taken as 0.6, assuming that PUJs are 60% full throughout their operation.

Number of Roundtrips and Utilization Factor

The number of roundtrips made by Katipunan-UP jeepneys and the utilization factor were obtained from the License Plate Survey while the number of roundtrips made by Katipunan-Balara jeepneys and the utilization factor were estimated based from operator interviews.

3.3.2 Sample Size

To maintain an acceptable level of statistical confidence, sample sizes were obtained using the formula given by Transportation Research Board (TRB). TRB defines sample as "a group of people selected to be surveyed and that the researcher attempts to contact."

Sample size, SS , is function of percent error and confidence level. It is used to provide surveyors the number of samples corresponding to a certain confidence level specified. For a known number of population as that of the conducted surveys, a finite population correction can be applied given by,

$$\text{New } SS = \frac{SS}{1 + \frac{SS-1}{N}} \quad (4)$$

Where:

- New SS = New Sample Size
- SS = "Old" Sample Size
- N = Estimated Population

The *New SS* refers to the actual total number of respondents from the Origin-Destination survey. *N* refers to the actual served passenger demand. With these values, the remaining variable *SS* can be obtained. The result from the finite population correction will be applied to the equation for infinite or unknown number of population given by,

$$SS = P \times (1 - P) \times (Z/E)^2 \quad (5)$$

Where:

- SS = "Old" Sample Size
- P = Proportional of sample elements having particular attribute
- Z = 1.96 for 95% Confidence level
- E = Percent Error

The variable *P* refers to the ratio between the number of actual respondents and the target number of respondents from the Origin-Destination survey. Manipulation of the equation yields the value of the only unknown variable percent error, *E*. Based on the Transportation Research Board 2005, a 5-10% percent error is commonly acceptable for transit surveys.

3.3.3 Origin-Destination Matrix

The Origin-Destination Matrix (OD Matrix) is prepared for a more systematic analysis and presentation of the results of the Origin-Destination Survey. The OD Matrix shows the number of passenger trips from one zone to another.

Zones	1 2 ... j ... n	Productions
1	T ₁₁ T ₁₂ ... T _{1j} ... T _{1n}	O ₁
2	T ₂₁ T ₂₂ ... T _{2j} ... T _{2n}	O ₂
:	:
i	T _{i1} T _{i2} ... T _{ij} ... T _{in}	O _i
:	:
n	T _{n1} T _{n2} ... T _{nj} ... T _{nn}	O _n
Attractions	D ₁ D ₂ ... D _j ... D _n	T

Figure 4. Notations of an Origin-Destination Matrix

Where:

- 1, 2, i, j, n = Zones
- T_{ij} = Number of trips from zone i to zone j
- O_i = Total number of trips originated from zone i
- D_j = Total number of trips attracted to zone j
- T = Total number of trips

The zoning of the study area must be defined before generating the OD Matrix. Zones are small units usually defined by administrative purposes and land

use. The zoning map was adapted from the zoning map used by Apilade and Perez (2013) shown in Figure 5. Zones 1 – 16 are the internal zones, or the zones within the study area while Zones 17 – 34 are external zones which are also included since they may greatly affect trip generation in the study area.



Figure 5. Zoning Map of the Study Area

Trip occurrences made between origin-destination pairs are drawn on the study map using straight lines connecting the assumed centroids of zones for better presentation and visualization of the results of the origin-destination survey. These straight lines are called desire lines. The thickness of the desire lines is proportional to the number of trips.

4. RESULTS AND DISCUSSION

4.1 Boarding and Alighting Survey

The numbers of boarding and alighting passengers and the average occupancy (solved using equation 3) in every loading and unloading point along the route were obtained. Figures 6, 7, 8, 9, 10, and 11 show average boarding and alighting passengers and average occupancy for the specified peak hours for Katipunan-UP and Katipunan-Balara transport lines, respectively.

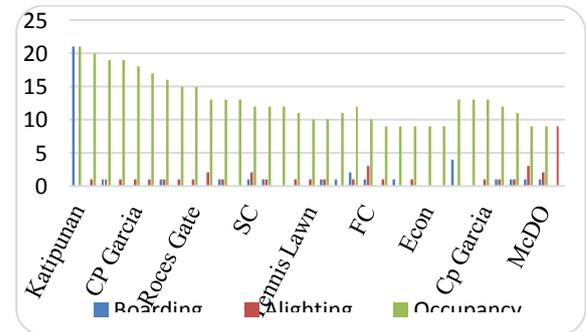


Figure 6. Load Profile of Katipunan-UP (AM PEAK)

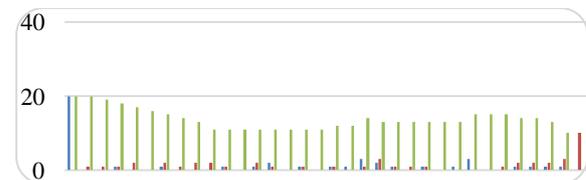


Figure 7. Load Profile of Katipunan-UP (NN PEAK)

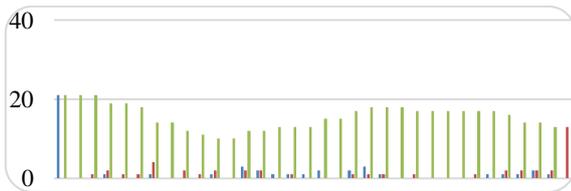


Figure 8. Load Profile of Katipunan-UP (PM PEAK)

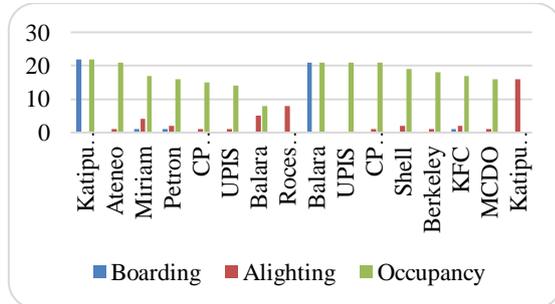


Figure 9. Load Profile of Katipunan-Balara (AM PEAK)

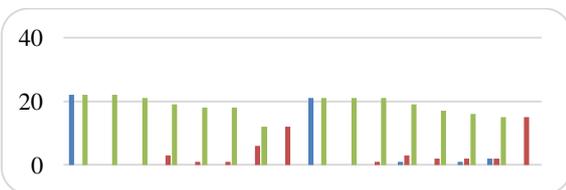


Figure 10. Load Profile of Katipunan-Balara (NN PEAK)

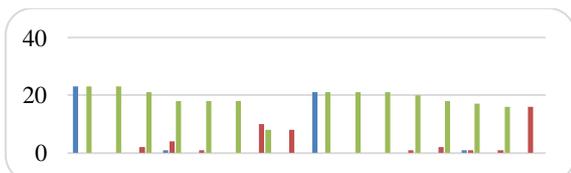


Figure 11. Load Profile of Katipunan-Balara (PM PEAK)

The average occupancy of Katipunan-UP jeepneys for the specified peak hours are 13, 14 and 15, respectively, for an average of 14. Meanwhile, the average occupancy of Katipunan-Balara jeepneys used is the greater between the average occupancy from Katipunan to Balara and from Balara to Katipunan, which are 17 and 19, respectively. Hence, an average occupancy of 19 was used.

4.2 License Plate Survey

4.2.1 Frequency

Figure 12 shows the profile of the average hourly frequency of jeepneys entering and leaving the campus. The average frequency of Katipunan-Balara jeepneys in a day is 478.

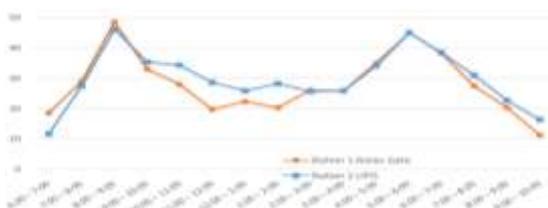


Figure 12. Hourly Frequency of Jeepneys

4.2.2 Actual Number of Roundtrips and Utilization Factor

The number of roundtrips and utilization factor obtained in the survey are 7.42 and 0.81, respectively.

4.3 Seating Capacity Survey

The obtained average seating capacity of Katipunan-UP and Katipunan-Balara jeepneys are 20 and 21 respectively.

4.4 Interview Results

Based on interviews conducted with drivers of Katipunan-Balara jeepneys, the number of roundtrips each driver makes varies from 9 to 12 trips with 40 unique jeepney units operating everyday.

4.5 Route-Measured Capacity

4.5.1 Served Demand

Using the obtained values from the previous discussions, estimation of number of required units for the served demand was done.

93 units are required everyday to satisfy the averaged passenger demand of 6611 considering an averaged number of roundtrips of 7.42. Their restriction to just 7 roundtrips per day can be a result of operators needing to fall in line when they arrive at the Katipunan terminal. Meanwhile, it can be observed that if operators could maximize 10 hours of work for 10 roundtrips, only 69 jeepney units will be needed to satisfy the same demand. The current number of units can satisfy the demand if each jeepney unit will make 9 roundtrips per day.

74 units are required everyday to satisfy the averaged passenger demand of 7793 considering an averaged number of roundtrips of 10.5. Their restriction to just 9 roundtrips per day can be a result of operators needing to fall in line when they arrive at the Katipunan terminal. Meanwhile, it can be observed that if operators could maximize 12 roundtrips per day, only 64 jeepney units will be needed by to satisfy the same demand.

4.5.2 Unserved Demand

At 9 roundtrips per jeepney per day, Katipunan-UP Jeepneys can accommodate up to 5% unserved demand while at 10 roundtrips per day, they can accommodate up to 10% unserved demand.

Even at maximum roundtrips per jeepney, Katipunan-Balara jeepneys cannot accommodate unserved demand.

4.5.3 Peak Hours

At morning and noon peak hours, the number of jeepneys required are 79 and 69, respectively, which

are sufficient to serve the demand while at afternoon peak, the number of jeepneys is insufficient. But if the number of roundtrips is maximized to two, the required number of jeepneys is decreased to 65.

4.5.4 Comparison of Data

The number of required units obtained were compared to the number required units calculated by Apilado *et al.* (2013) on their previous research and observed a 5% difference between the results. This may be seen as a result of the increasing population accessing the campus thus increasing the demand and the difference in conducting the surveys.

4.6 Origin-Destination Survey

4.6.1 Sampling Error

Out of the 228 people surveyed for the Origin-Destination, 134 responded. Using the served passenger demand of 6611, the finite population correction (Equation 4) was applied to obtain the sample size, SS, which is equal to 236. This value was then used to calculate for the sampling error using Equation 5. The sampling error is equal to 6.28%.

The same process was done to calculate the sampling error for the Katipunan-Balara transport line. Using the values 737 (number of respondents), 7793 (served passenger demand), 0.5 (assuming 50% of the passengers participated in the survey), the sampling error is equal to 3.44%.

4.6.2 Statistical Data

Different figures were obtained from the 134 respondents' answers to the survey questions as shown in Figures 13, 14 and 15.

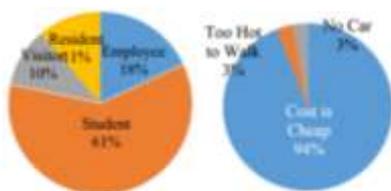


Figure 13. Passenger Type and Reason for Using PUJ

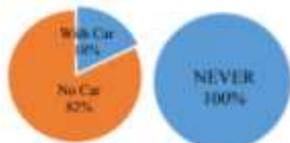


Figure 14. Car Ownership and Frequency of Missing the Trip



Figure 15. Passengers of Katipunan-Balara

Although the unserved demand is important in determining the total number of required units, Figure 11 suggested that the analysis of the number of units without unserved demand is acceptable.

4.6.3 Origin-Destination Matrix

The Origin-Destination Matrix for UP-Katipunan Route was generated based on the original origin and final destination of passengers. The number of trips from one zone to another was then placed in the Origin-Destination Matrix shown in Table 1 and illustrated through desire lines in Figure 16.

Table 1. Origin-Destination Matrix

ORIGIN	1	2	3	4	5	7	8	15	16	17	18	19	24	27	28	29	32	444
2							187											
8								157										
15									45									
16										45								
17											90							
18												45						
19													45					
24														45				
27															45			
28																137		
29																	1274	
32																		1433
444																		
445																		

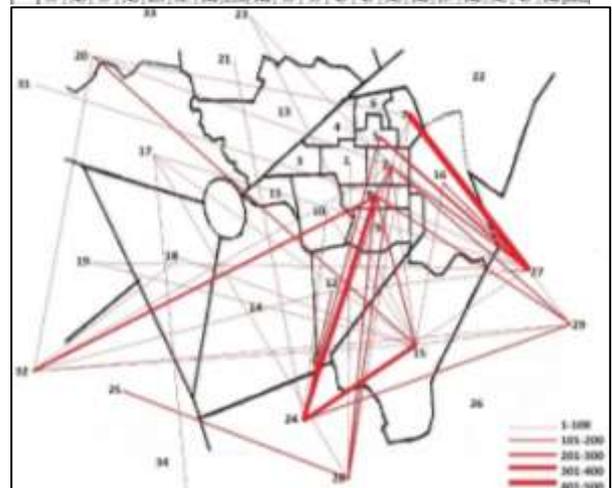


Figure 16. Desire Lines

The top 5 OD pairs were determined by observing Figure 16 and Table 1. The top 5 OD pairs shown in Table 2 can be helpful in transportation planning which may include design purposes and route modification.

Table 3. Top 5 OD Pairs

1	7 - Ilang-Ilang, IC, Dagohoy, Ricarte, Univ. Hotel, Palaris	27 - Marikina
2	15 - ADMU, Miriam College, Katipunan, Baranka, Pansol	24 - Proj.2, Silangan, Anonas, Cubao, Proj.3, Proj.4
3	8 - AS, PHAN, FC, CAL, Nismed, NSRI, OUR, CHE, Educ, Kamia, Sampa	24 - Proj.2, Silangan, Anonas, Cubao, Proj.3, Proj.4
4	5 - Ipil, Kalayaan, Molave, Yakal, School of Statistics, Shopping Center, UHS, Parish	27 - Marikina
5	8 - AS, PHAN, FC, CAL, Nismed, NSRI, OUR, CHE, Educ, Kamia, Sampa	32 - Manila

Based from Figure 8, 61% of passengers are students. This is also reflected by the Origin-Destination Matrix since the majority of trip attractions were to the Universities. Out of 6612 passenger demand, 3110 were going to UP Campus and 1530 were going to Zone 15 (Ateneo de Manila University and Miriam College) which sums up to 4640 or 70% of the passenger demand.

5. CONCLUSIONS

5.1 Summary of Findings

Results of the Boarding and Alighting Survey showed that the average occupancies of Katipunan-UP and Katipunan-Balara operating for a day are 14 and 19 while the average seating capacities are 19 and 21, respectively. The average frequency of Katipunan-UP jeepneys in a day which was obtained from License Plate Survey is 478 trips. The same survey also gave the number of roundtrips and the utilization rate of Katipunan-UP jeepney units which are 7.42 and 0.81.

Using the data gathered from the field surveys, the estimated passenger demand for Katipunan-UP transport line in a day was found to be 6,611 passengers while for Katipunan-Balara transport line, the passenger demand was found to be 7,793 passengers. These values, however, were the demand for a regular school week whereas these values would decrease for months without classes or during weeks with holidays.

From the OD Survey, it was observed that 99% of passengers going to or coming from UP Campus choose to ride Katipunan-UP jeepneys and not Katipunan-Balarajepneys. It showed that Katipunan-Balara is mainly used by passengers going to zones outside UP.

5.2 Conclusions from the Study

Based from the actual number of roundtrips Katipunan-UP jeepneys make in a day, the number of jeepney units required to satisfy the demand is 93, assuming that there is no unserved demand. This means that Katipunan-Jepney units lack 13 jeepney units. However, since the number of roundtrips each jeepney makes in a day is limited by different factors such as falling in line in the terminal and competition with other jeepney units, increasing the number of roundtrips to 10 showed that only 69 units is required for the transport line assuming no unserved demand and the actual number of units which is 80 is sufficient for the total demand assuming that the unserved demand is 10% of the total demand. On the other hand, using the same principle in estimating the required number of jeepneys for Katipunan-Balara line, results showed that at 80% utilization rate and at maximum number of roundtrips each jeepney unit can make in a day, the number of jeepney units which is 64 is just enough assuming that there is no unserved demand.

Results of the Origin Destination Survey using the derived zoning showed that Katipunan-UP jeepneys attract passengers mostly from Marikina and passengers going to Ateneo and Miriam. However further observations showed that almost 50% of passengers are going to UP Campus.

The number of required Katipunan-UP jeepney units obtained in this study and by Apilado and Perez (2013) is 93 and 89 units, respectively. The 5% discrepancy in the results may be attributed to the increasing demand every year and the difference in the implementation of field surveys.

For the meantime, additional number of Katipunan-UP Jeepneys is not recommended. On the other hand, further investigation including actual frequency of trips of the Katipunan-Balara transport units and/or Origin-Destination survey must be done for a better assessment of the transport line. Though the required number of units for the second transport line obtained suggest that there should be an increase, this may be not the case if further research will be implemented.

6. RECOMMENDATIONS

It is recommended to do field surveys in obtaining certain parameters used in calculations such as frequency of jeepneys in a day, and number of roundtrips for the second transport line. License Plate Survey may be needed for higher accuracy in the estimation of the passenger demand.

Estimation of the passenger demand may be improved by measuring unserved demand. Surveying other transport modes along the Katipunan Avenue, like taxis, tricycles, or even buses may be done to represent the passengers who were not able to board the jeepneys. It is recommended to do Transportation Modelling for better analysis of the relationship of the supply and demand for jeepneys along the route.

REFERENCES

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