

Determination of Appropriate Public Transportation Mode for a University Transit Route in Accordance with the Omnibus Franchising Guidelines

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Abstract: New franchising guidelines of public utility vehicles are released and are stated in the Department Order No. 2017-011 of the Department of Transportation (DOTr). According to the order, public utility jeepneys (PUJs) are “restricted from operating along EDSA and national highways... in highly urbanized areas” (DOTr, 2017). With this, Philcoa will serve as a transfer area for passengers going in and out of UP via University Avenue. Given that, the appropriate public transport mode/s that would operate along the consolidated UP-Philcoa route is/are determined, including the number of units needed. As a result, two modes are proposed– Mini-buses and PUJs. If mini-buses would be used, 48 units are required during peak hours; on the other hand, 65 PUJs are needed if PUJs would be considered.

Keywords: Omnibus Franchising Guidelines, Public Utility Vehicles, Transfer Area, UP-Philcoa Route, Mini-bus, Public Utility Jeepney (PUJ)

1. INTRODUCTION

The Department of Transportation (DOTr) of the Philippines has released an order that concerns the modernization of Public Utility Vehicles (PUVs). On June 19, 2017, DOTr published the Department Order No. 2017-011 or “Omnibus Guidelines on the Planning and Identification of Public Road Transportation Services and Franchise Issuance”, often referred as Omnibus Franchising Guidelines (OFG).

In effect of the new order, local government units (LGUs) are given the task to propose Local Public Transport Route Plans (LPTRPs) for their respective areas (DOTr, 2017). The specifications and requirements in constructing route plans are indicated in the Local Public Transport Route Plan Manual. One of the requirements in constructing LPTRPs is the selection of the appropriate public mode of transportation (DOTr et al., 2017) for the routes that are affected by the new order, depending on the passenger demand and the classification of roads as indicated in (DOTr, 2017).

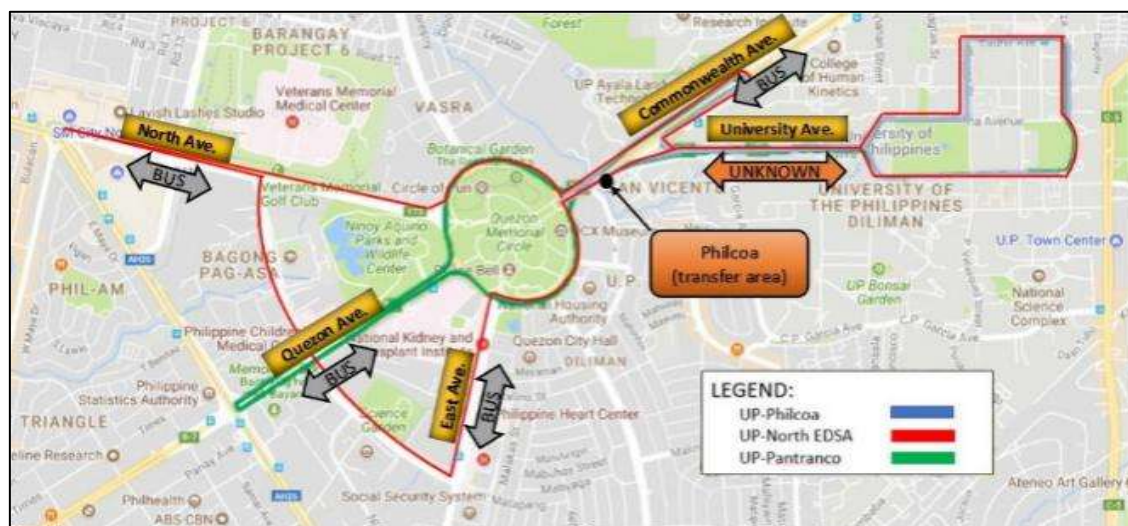
Given the new situation on road transportation, LGUs and several national government agencies, such as the Department of Transportation (DOTr), Department of the Interior and Local Government (DILG), and Land Transportation Franchising & Regulatory Board (LTFRB), are working on the public transport route planning in observance of the OFG (DOTr et al., 2017).

1.1 Statement of the Problem

According to OFG, Public Utility Jeepney (PUJ) is one of the public transportation modes that will be “restricted from operating along EDSA and national highways or expressways in highly urbanized areas” (DOTr, 2017). In addition, it is also stated in the OFG that only small sections of the said roads can be traversed by PUJs (DOTr, 2017), hence, signifying that PUJ operations on national highways are going to be limited.

For this study, the researchers will focus on the PUJs that are operating in University of the Philippines (UP) Diliman campus. Specifically, PUJs that are entering and exiting UP via University Avenue, which are comprised of the following: UP-Philcoa, UP-North EDSA, and UP-Pantranco jeepneys. Currently, the said jeepneys are operating along Commonwealth Avenue, Quezon Avenue, East Avenue, and North Avenue which are classified as national secondary highways according to 2017 DPWH Atlas.

Given the new order, public utility buses (PUBs) and mini-buses are preferred to traverse along major transport corridors (DOTr, 2017). If PUBs and/or mini-buses are expected to operate along the abovementioned national secondary roads, the passengers that are travelling in and out of the university are expected to alight and at an area near the University Avenue. Considering the existing transportation system, Philcoa is still the nearest transfer area for passengers travelling along Commonwealth Avenue. Hence, when the OFG is strictly implemented, the likely scenario to take place is that passengers that are going in and out of UP Diliman are expected to alight and board PUBs and/or mini-buses at Philcoa. Given the possible situation, there will no longer be a direct trip from the campus to different transport terminals, such as SM North and MRT-3 Quezon Avenue station. However, the public transport mode to be used for the consolidated UP-Philcoa route is still unknown for the presented scenario. To visualize the scenario described, refer to Figure 1.



****Figure 1. Visual representation of the Omnibus Franchising Guidelines scheme on PUV modernization**

1.2 Objectives

The main objective of this study is to propose appropriate mode/s of public transportation for the consolidated UP-Philcoa route.

In order to meet the main objective, the following specific objectives should be accomplished:

- estimate the served passenger demand (in passengers per hour per direction) of the UP-Philcoa segment which is currently traversed by the UP-Philcoa, UP-North EDSA, and UP-Pantranco PUJs, and,
- identify the mode/s of public transportation that is/are suited for the consolidated UP-Philcoa route based on DOTr's OFG

Furthermore, the required number of public utility vehicle (PUV) units for the consolidated UP-Philcoa route will be estimated.

1.3 Scope and Limitations

This study will focus on identifying the public transport mode/s that will be suitable to operate along the consolidated UP-Philcoa route. Hence, only the passenger demand of the UP-Philcoa segment will be estimated for each of the following PUJ routes: UP-Philcoa, UP-North EDSA and UP-Pantranco.

Note that the passenger demand that will be obtained in this study is only the served demand during the typical operating hours of the PUJs. Thus, the estimation of the number of PUV units that will be needed for the consolidated UP-Philcoa route will only be based on the served passenger demand.

As for the selection of the appropriate mode of public transportation for the consolidated UP-Philcoa route, only PUJs, mini-buses and PUBs are to be considered as possible transport modes for this study since they are the usual public utility vehicles (PUVs) that are used for mass transit due to their large capacity. Note that PUJs will still be considered as a possible option for transport mode in the consolidated UP-Philcoa route considering that only a small portion of the Commonwealth Avenue will be covered.

1.4 Framework of the Study

As stated in the order, LGUs will be the ones in-charge of the public transport route planning of their respective areas, thus, they will be proposing LPTRPs (DOTr et al., 2017). Aside from LGUs, special areas are also entitled to propose their own route plans according to Joint Memorandum Circular No. 001 by DOTr and DILG (2017). Moreover, special areas pertain to “areas wherein their respective transport plans are developed independent of the LGUs, including but not limited to Special Economic Zones (SEZs) and university complex” (DOTr & DILG, 2017). Hence, as UP Diliman is a university, by the mentioned joint memorandum, it is considered a special area and is entitled to propose its own LPTRP.

To accomplish the task, several requirements are given by DOTr- two of which are part of the scope of this study. Firstly, the public transport mode selection which would be based on the passenger demand to be estimated and the hierarchy of roads to be traversed (DOTr, 2017) and, secondly, the estimation of number of vehicle units which is dependent on several factors: seating capacity, utilization rate, number of round-trips, viable load factor, and passenger demand (DOTr et al., 2017). To visualize the research framework, refer to Figure 2.

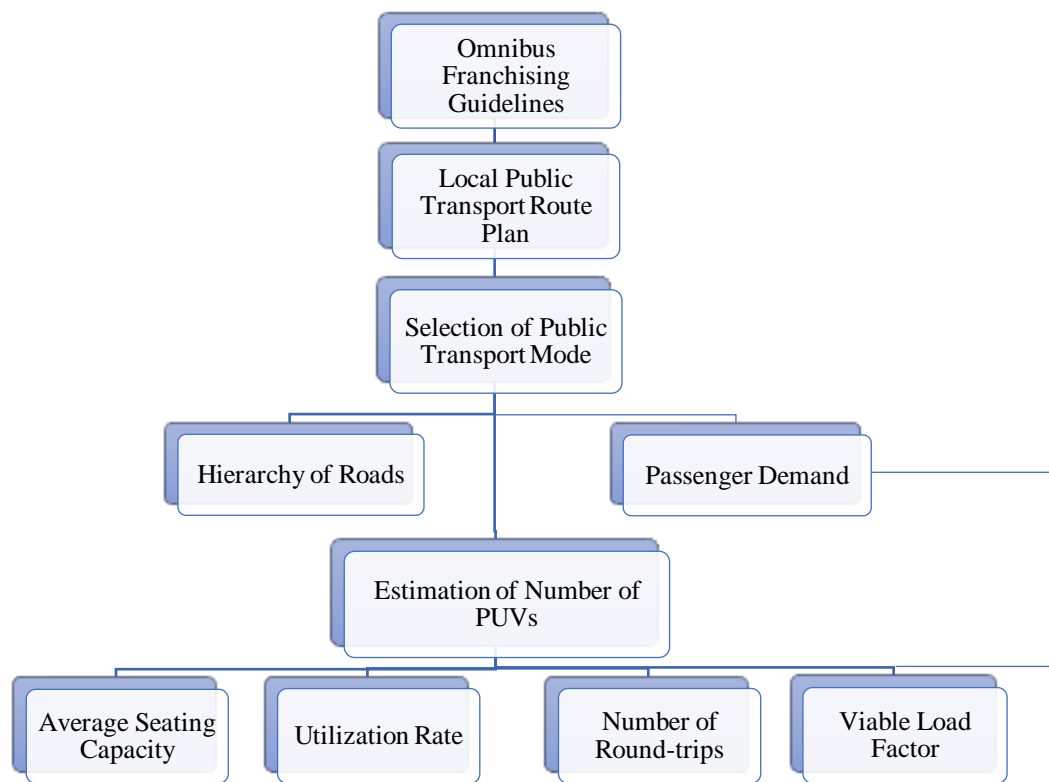


Figure 2. Research framework

2. REVIEW OF RELATED LITERATURE

As mentioned in the OFG, different modes of public transportation are preferred to operate along routes depending on the passenger demand and the classification of the roads in which the PUVs are expected to operate (DOTr, 2017). The table below is based on the OFG and Local Public Transport Route Plan Manual.

Table 1. Classification of public transport modes in relation to passenger demand

Modes of Public Transportation	Passenger Demand (PD)
PUB	PD > 5,000 pphpd
Mini-bus	1,000 pphpd < PD ≤ 5,000 pphpd
PUJ/UV Express	500 pphpd < PD ≤ 1,000 pphpd
Filcab	PD ≤ 500 pphpd

Based on the Local Public Transport Route Plan Manual, there are various traffic surveys that can be performed to acquire the required data for the route being studied; among the specified methods are the Boarding and Alighting Survey, and License Plate Survey. In the Metro Manila Urban Transportation Integration Study (MMUTIS) of Japan International Cooperation Agency (JICA) in 1999, the Boarding and Alighting Survey was conducted during peak hours in the morning (7:00 AM to 10:00 AM), noon (12:00 NN to 3:00 PM) and afternoon/evening (4:00 PM to 7:00 PM) of weekdays. Meanwhile, both field surveys were

conducted in the Mega Manila Public Transport Study (MMPTS) of JICA in 2007 from 6:00 AM to 10:00 PM for two survey days (one weekday and one weekend).

After collecting the data of the routes being studied, the required number of units for a certain route can be estimated using the formula (Eq. 1) for the Estimating Unit Requirement that is stated in the Local Public Transport Route Plan Manual (DOTr et al., 2017).

$$\text{Number of Units} = \frac{PD}{UR * VLF * USC * NRT} \quad (1)$$

where *PD*: passenger demand

UR: utilization rate

VLF: viable load factor

ASC: average seating capacity

NRT: number of round-trips per vehicle

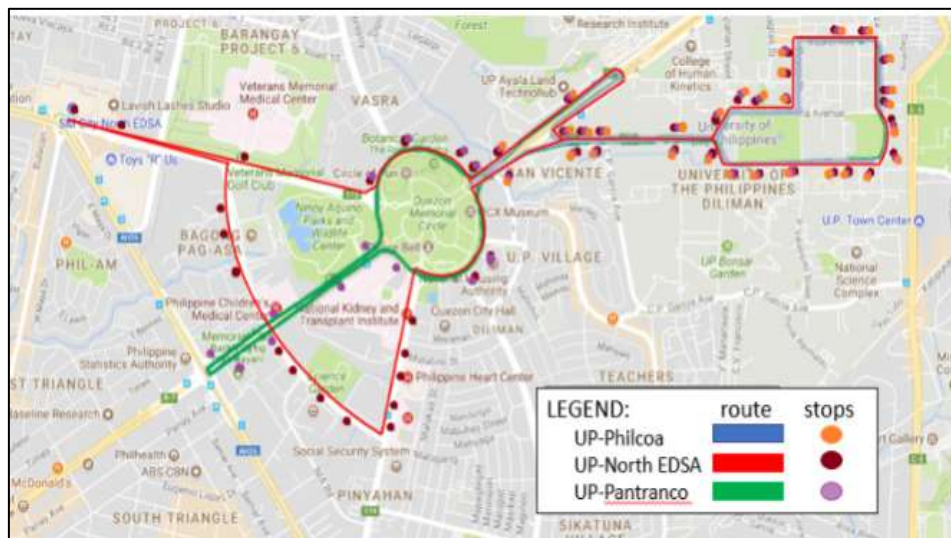
3. METHODOLOGY

3.1 Data Collection

Two (2) transport surveys- Boarding and Alighting Survey and Public Transport Frequency Survey- were conducted to determine the parameters needed for the research.

3.1.1 Boarding and Alighting Survey

Boarding and Alighting Survey was done to determine the average occupancy of PUJs on the following routes: UP-Philcoa, UP-North EDSA, and UP-Pantranco. The survey was conducted on the year 2018 for two weekdays, February 28 (Wednesday) and April 3 (Tuesday), and one weekend, February 24 (Saturday). It was performed for 16 hours a day, from 6:00 AM to 10:00 PM. One surveyor was assigned for each PUJ route. Note that 16 round-trips were required for the UP-Philcoa route for each survey day to have a representative data for each hour. On the other hand, at least 10 round-trips were required for the UP-North EDSA and UP-Pantranco routes per day. The stops surveyed per route are indicated in Figure 3.



****Figure 3. Jeepney stops along UP-Philcoa, UP-North EDSA and UP-Pantranco routes**

3.1.2 Public Transport Frequency Survey

Public Transport Frequency Survey was conducted to acquire the frequency of PUJs entering and exiting UP Diliman via University Avenue. The survey was performed from 6:00 AM to 10:00 PM for one weekday, April 3 (Tuesday), and one weekend, February 24 (Saturday). Survey stations were chosen for the PUJs entering and exiting UP; the UP Diliman Entrance Checkpoint for PUJs entering UP, and the UP Diliman Exit Checkpoint (Saturday) and the waiting shed at the Melchor Hall/Tennis Court (Tuesday) for the PUJs exiting UP. Two different locations were used as survey stations for the exiting PUJs due to the difficulty in the acquisition of data during the first day of survey (Saturday).



****Figure 4. Survey stations used in the Public Transportation Frequency Survey**

3.1.3 Secondary data

Supplementary data to the Public Transport Frequency Survey was acquired from the UP Diliman Police. A list of registered PUJs for UP-Philcoa, UP-North EDSA, and UP-Pantranco was provided by Sgt. Jimmy Marquina, a member of UP Diliman Police- Transport Management and Enforcement Team.

3.2 Data Analysis

3.2.1 PUV mode determination

The hourly served passenger demand were estimated by integrating the data from the Boarding and Alighting Survey and Public Transport Frequency Survey. The estimated served passenger demand was then compared with the ranges of passenger demands stated in the OFG and Local Public Transport Route Plan Manual to determine which mode/s is/are appropriate for the consolidated UP-Philcoa route.

3.2.2 Estimation of the required number of units

The required number of units was estimated using the equation (Eq. 1) in Section 2 that was given by DOTr et al. (2017) in the Local Public Transport Route Plan Manual.

4. RESULTS AND DISCUSSION

4.1 Served Passenger Demand

The average occupancy of PUJs from Boarding and Alighting Survey was determined only for the UP-Philcoa segment that was common to the respective route traversed by the UP-Philcoa, UP-North EDSA and UP-Pantranco PUJs. Meanwhile, the frequencies of UP-Philcoa, UP North EDSA and UP-Pantranco PUJs that operate in UP were determined for every hour of the observed service period using the Public Transport Frequency Survey data. By integrating the data of the conducted surveys, the hourly served passenger demand were acquired. The said demands were determined for weekday and weekend variation.

To further understand and visualize the trend of the served passenger demand of the UP-Philcoa segment, Figures 5 and 6 were generated.

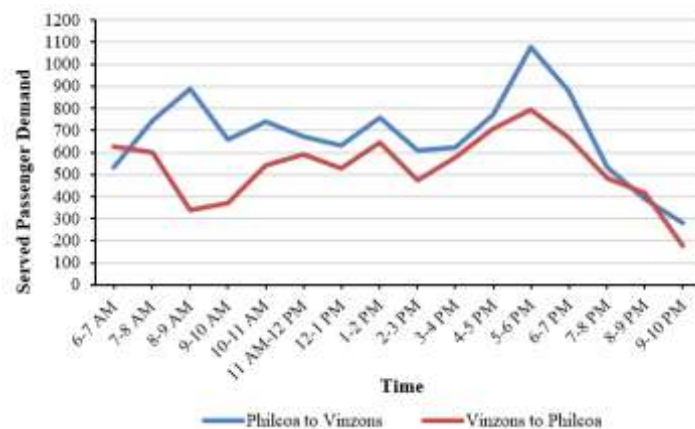


Figure 5. Hourly served passenger demand during weekdays

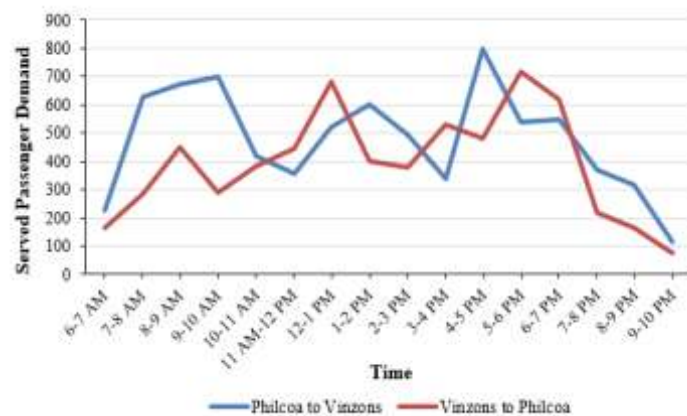


Figure 6. Hourly served passenger demand during weekend

Based on Figures 5 and 6, the estimated hourly served passenger demand for weekends were lesser compared to weekdays. This is because there are hardly any classes during Saturdays and only few offices are available for services, for instance, libraries. Hence, the number of students and employees that are going to and from UP tends to diminish during weekends.

It was observed that the passengers that were going in the direction of Philcoa to

Vinzons (UP) were higher as compared to those that were going outside of UP during weekdays (Refer to Figure 5). One reason for this was that UP serves as a transfer area for the passengers that are going to Katipunan area, thus, there are many passengers who are boarding the UP-Philcoa, UP-North EDSA and UP-Pantranco PUJs in order to transfer to UP-Katipunan jeepneys. Also, the survey days are usually the start of classes for the week, especially Tuesday, hence, it is expected that there are lots of students that are staying at the dormitories inside UP that would be arriving from the provinces. In addition, the peak served passenger demand could also be determined based on Figure 5. The peak passenger demand during morning occurred from 8:00 to 9:00 AM of the Philcoa to Vinzons (UP) direction, mainly because classes and office hours in UP usually start around 8:00 to 8:30 AM. Meanwhile, the peak passenger demand during the afternoon occurred from 5:00 to 6:00 PM for both directions. This is because class and office hours typically end at around 5:00 to 5:30 PM.

4.2 Selection of Public Transportation Mode/s for the Consolidated UP-Philcoa Route

The possible modes of public transportation to be considered for the consolidated UP-Philcoa route were listed in Table 2, together with the range of passenger demand that they should serve in accordance with DOTr's OFG.

Table 2. List of possible modes of public transportation

Modes of Public Transportation	Passenger Demand (PD)
PUB	PD > 5,000 pphpd
Mini-bus	1,000 pphpd < PD < 5,000 pphpd
PUJ	500 pphpd < PD ≤ 1,000 pphpd

Given the abovementioned public transportation modes, PUJ was the appropriate mode for the consolidated UP-Philcoa route based on the weekend variation of served passenger demand. This was because the highest hourly served passenger demand during weekends had a value of 797 which was found within the range of passenger demand for the PUJs based on Table 2. However, if the weekday variation was to be considered, mini-bus was the public transportation mode suitable for the UP-Philcoa route since the highest hourly served passenger demand was 1,079.

Since the hourly served passenger demand from the weekday variation were mostly greater than the weekend variation (Refer to Figures 5 and 6), the passenger demands for the weekday variation were considered in the selection of the appropriate mode of public transportation. Thus, mini-buses are suitable to operate along the UP-Philcoa route in accordance with the OFG. However, there was only a small difference between the mentioned value and the boundary of PUJs; thus, the researchers decided to propose PUJ as another option of public transport mode considering that it would only be operating along a small portion of the Commonwealth Avenue.

4.3 Estimation of Unit Requirement

Due to the new PUV modernization scheme, passengers entering UP Diliman via University Avenue must transfer at Philcoa and enter UP using the identified mode/s of public transportation in the previous section. To allocate enough facilities to supply the demand of the consolidated UP-Philcoa route, the required number of units must then be estimated using

the suggested mathematical approach in the Local Public Transport Route Plan Manual, which is indicated as Eq. 1 in Section 2.

4.3.1 Passenger demand

In estimating the number of required units, the served passenger demand for the weekday variation was used since the served passenger demand for the weekend variation was already within the range of weekday variation. Hence, only the weekday data was considered in the succeeding sections (Sections 4.3.2 to 4.3.6). However, the estimation of unit requirement for the weekend, including the weekend counterparts of the tables from Sections 4.3.2 to 4.3.6, are shown in the Appendix.

4.3.2 Utilization rate

From the data gathered through the Public Transport Frequency Survey, the number of operating units per route was determined to be 12, 25, and 39 for UP-Philcoa, UP-North EDSA, and UP-Pantranco, respectively, having a total of 76 operating units. Moreover, from the information acquired in the UP Diliman Police, the total number of currently registered PUJs that are of service for ingoing and outgoing passengers in UP Diliman is 147, where the breakdown of distribution is 30 from UP-Philcoa, 40 from UP-North EDSA, and 77 from UP-Pantranco routes. Given that information, the actual utilization rate per route was calculated by dividing the number of operating units to the total available units. By doing so, the yielded utilization rate for UP-Philcoa, UP-North EDSA, and UP-Pantranco were 0.4, 0.625, and 0.506, respectively. The average utilization rate of the three routes was calculated to be 0.51. Utilization rate is used to consider the units that are at downtime due to maintenance and repair. Given that, it is still not justifiable to produce just a 50% utilization of the capacity of the consolidated UP-Philcoa route.

Therefore, for the estimation of required units, an ideal design value of utilization rate was used. Based on the researches conducted by students of UP Diliman [Valdez (2011), Anaque and Landingin (2012), and, Apilado and Perez (2013)] regarding the public transportation system in the campus, a value of 0.85 was used as the utilization rate in their studies. Moreover, according to the Officer in Charge of DOTr's Road Transport Planning Division (RTPD), a utilization rate of 0.70, 0.85, or 0.90 is being used by the department in the design or estimation of the number of PUJs. Also, in the study of Manresa, Vergel, and Regidor (2015), the actual utilization ratio of 0.70 was used in the estimation of the number of air-conditioned bus units needed in the Davao City-Surigao City route. In summary, the specified researchers used a utilization rate value within the range of 0.70-0.90. Since the yielded actual utilization rate of this study is too deviant, an average value of 0.85 was used.

4.3.3 Viable load factor

The passenger load factor per route was calculated by averaging the occupancy over seating capacity per stop in percentages to normalize the differences in seating capacities. The summary of results was tabulated in Table 3.

Table 3. Passenger load factor per route

Routes	Passenger Load Factor, %
UP-Philcoa	65.80
UP-North EDSA	72.00
UP-Pantranco	53.53

Average	63.78
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Based on the technical report of UP National Engineering Center et al., (2013) about the DOE Alternative Fuels Vehicle Tests & Research Program and Energy Efficiency in Road Transport, the overall average load factor of PUJs loaded with diesel along UP-North EDSA route was 63%. Although the said report of UP-NEC et al. (2013), in relation with the project of the Department of Energy (2013), only covered one of the three routes under this research, it could still be of use as basis and as a comparison since the government project was extensive, and hence, assumed to be close to the actual and existing load factor of UP-North EDSA. Since the actual passenger load factor of this research was close with the overall average load factor of PUJs resulting from the technical report of UP-NEC et al., (2013), the value of 64% passenger load factor could be verified. Furthermore, the range of acceptable viable load factor, according to the Local Public Transport Route Plan Manual of DOTr et al. (2017), was from 0.60 to 0.80, to which the theoretical passenger load factor was within range. Hence, to be conservative, it was assumed that at 60% average occupancy, the PUJs were already receiving a viable profit.

4.3.4 Average seating capacity

According to the served passenger demand determined in this research, two modes of public transportation could be suggested for the consolidated UP-Philcoa route: mini-buses and PUJs.

From the Philippine National Standard (PNS) 2126:2017, the average seating capacity of modernized PUJs for a Class 3 or UNECE Category M2 Class III is 22 (BPS, 2017). As for the mini-buses, it was stated in Department Order No. 97-1097 that mini-buses can serve 30 to 49 passengers (DOTC, 1997). Again, to be conservative with the design, the lower limit of available seating capacity was used.

4.3.5 Number of round-trips

By counting and averaging the actual number of trips that a PUJ unit has covered based on the data from Public Transport Frequency Survey, the number of roundtrips were estimated. Since the focus of the study was the UP-Philcoa segment, only the number of round-trips of UP-Philcoa PUJs per hour was observed. Each PUJ unit of the mentioned route operated one to two round-trips per hour, which could be estimated to an average of 1.5 round-trips per hour.

4.3.6 Number of required PUV units

After establishing all the parameters needed, Eq. 1 in Section 2 was used in calculating the number of required PUJ and mini-bus units that will supply the estimated served passenger demand. The summary of parameters for the estimation to is shown below.

Table 4. Parameters for the estimation of required number of units

Parameters	Values
Utilization Rate	0.85
Viable Load Factor	0.6
Average Seating Capacity	22 (PUJ) 30 (mini-bus)
Number of Round-Trips	1.5 (per hour)

The estimation was done per type of suggested mode of transportation. Peak-hour analysis was done to determine the served passenger demand to be used in the estimation. The following peak hours were observed—6:00 AM to 9:00 AM, 11:00 AM to 2:00 PM, and 4:00 PM to 7:00 PM.

4.3.6.1 Mini-bus

The served passenger demand (in pphpd) used in the peak-hour analysis are shown in Table 5. These values were chosen from the direction which had the higher set of values, in this case, the direction from Philcoa to Vinzons Hall. Using the parameters in Table 4 and plugging it to Eq. 1 in Section 2, the number of units needed to serve its corresponding passenger demand were calculated.

Table 5. Peak-hour analysis results for mini-buses

Peak Hours		pphpd	Peak pphpd	Required No. of Units
AM	6-7 AM	746	887	39
	7-8 AM	887		
	8-9 AM	658		
NN	11 AM-12 PM	632	758	34
	12-1 PM	758		
	1-2 PM	608		
PM	4-5 PM	1,079	1,079	48
	5-6 PM	879		
	6-7 PM	531		

Given the results of the peak-hour analysis, this implies that on an hourly basis, the maximum number of mini-buses needed would be 34 to 48 units. If this mode will govern during implementation of the new PUV scheme according to the Omnibus Franchising Guidelines, possibly, the Commonwealth Avenue and University Avenue will only be traversed by mini-buses and PUBs. Since mini-buses can carry more passengers at a time, trips made will be more efficient and beneficial to passengers, especially during peak hours. Also, less volume of mini-buses is going to be needed due to its bigger capacity—hence, less units of vehicle will operate along the avenues, making it less crowded. However, due to its bigger capacity, it will take more time to fill up a single unit especially during off-peak hours. In line with modernization, there are no existing proposals regarding mini-buses. Planning and production of modernized mini-bus models will most likely take several years to be able to put into operations, which will delay, if not postpone, the wanted modernization. Existing models of mini-buses are already outdated, whose road worthiness are already questionable. Upgrading such models will also take an ample amount of time and budget, therefore, making its cost and operation efficiency, also, questionable.

4.3.6.2 Public Utility Jeepney

Same procedure was done to determine the number of units for PUJs. The same set of peak-hour served passenger demand was used. The results of the peak-hour analysis is summarized in Table 6.

Table 6. Peak-hour analysis for PUJs

Peak Hours		pphpd	Peak pphpd	Required No. of Units
AM	6-7 AM	746	887	53
	7-8 AM	887		
	8-9 AM	658		
NN	11 AM-12 PM	632	758	46
	12-1 PM	758		
	1-2 PM	608		
PM	4-5 PM	1,079	1,079	65
	5-6 PM	879		
	6-7 PM	531		

Using the same analysis as the mini-buses, 46 to 65 PUJ units are needed during peak hours, to accommodate the estimated served passenger demand. If modernized PUJs will be operating along University Avenue, the scenario when the PUV modernization scheme takes effect could be predicted since it is almost the same with the current situation. The only difference would be the effect of the difference on operational functions of the proposed modernized PUJs to current operating ones. Due to the new parts and engines, modernized PUJs would less likely need a repair and would be more fuel-efficient compared to the current operating PUJs. Hence, traffic jams due to PUJ accidents because of loss of break or overheating could be avoided. Also, at peak-hours of passenger demand, greater assurance of enough supply of modernized PUJs could be accounted for.

4.3.7 Observation of the current transportation system in UP Diliman

Recalling the actual utilization rate of current PUJ operation in Section 4.3.2, about 51% of the total available units were operating. This utilization rate was alarmingly low and inefficient; hence, it was concluded to be unacceptable. To further understand the cause of it, the required number of operating units along the UP-Philcoa segment was calculated for each route and compared to the actual number of PUJ units operating per route. The deviation, in percentages, was acquired to know if the supply was sufficient to serve the demand. The stated comparison in units was tabulated at Table 7.

Table 7. Comparison of the required and actual number of operating PUJs

Variables	UP-Philcoa	UP-North EDSA	UP-Pantranco
Total Served PD	2,233	3,720	4,836
NRT	9.5	9	7.5
ASC	20	21	21
No. of Required Operating Units	24	39	61
No. of Actual Operating Units	12	25	39
Deviation (%)	-50	-35.90	-36.07

In the table, the results of the comparison showed that for all three routes, there was a daily undersupply of units. To visualize the trend, refer to Figure 7. The height of the blue bars refers to the required number of operating PUJ units, while the height of the yellow bars refers to the actual number of operating PUJ units.

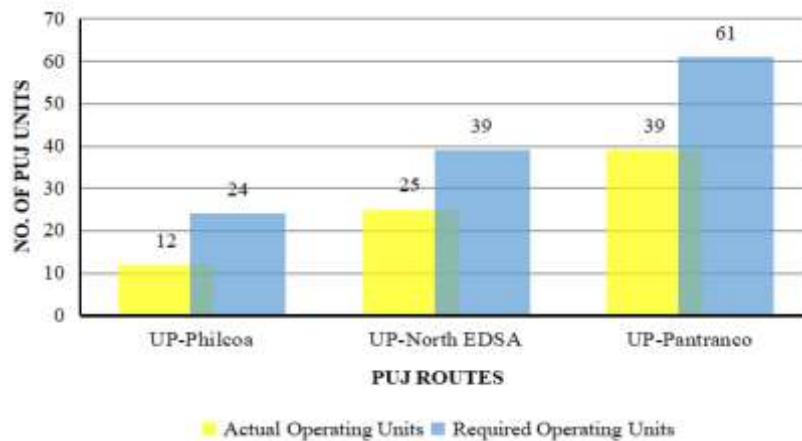


Figure 7. Deviation between the required and actual number of operating PUV units

The passenger demand accounted for the estimation of required number of operating units were only the served ones, it would only mean that greater insufficiency of PUVs exists. Hence, theoretically, the number of operating units should be increased to accommodate the total passenger demand, served and unserved, throughout the day. In summary, it could be concluded that the yielded utilization rate of the routes at an average of 0.51 was due to low number of operating units.

5. CONCLUSION

There are two public transport modes that are to be used in the consolidated UP-Philcoa route – (1) Mini-bus and (2) Public Utility Jeepney. Conservatively following the guideline, the peak served passenger demand of 1,079 pphpd from the weekday variation falls in the category of mini-buses. However, since the passenger demand is very close to the range of values for PUVs, this mode is also considered as another option of public transport mode for the consolidated UP-Philcoa route considering that only a small portion of the Commonwealth Avenue would be covered by them. Note that PUVs are still allowed to operate along major transport corridors if they will only traverse small sections of the said roads (DOTr, 2017).

Aside from determining the public transport modes for the consolidated UP-Philcoa route, the corresponding number of PUV units for each mode were also estimated. If mini-bus are to be considered for the consolidated UP-Philcoa route, 48 units are needed to feed the peak served passenger demand of 1,079 passengers. On the other hand, if PUVs are to be used in the said route, 65 units are required to serve the passengers.

6. RECOMMENDATION

6.1 Research Recommendation

This research only considered the served passenger demand, excluding the unserved demand. To get the required number of units that would feed the total passenger demand, comprised of

both served and unserved demands, it is recommended that a study on determining the unserved passenger demand should be done. Since the sensitivity analysis that was performed by Valdez (2011), Anaque and Landingin (2012), and Apilado and Perez (2013) was just an estimation and was not based on the actual number of the unserved demand, it is highly recommended to do further researches regarding the matter.

Also, the economic aspect was not included in the scope of this study. Hence, the viable load factor, which was a parameter in estimating the number of PUV units, was assumed. It is recommended by the researchers to make further study about it and determine the actual viable load factor of the routes under study- UP-Philcoa, UP-North EDSA, and UP-Pantranco. The equations proposed by DOTr et al. (2017) in the Local Public Transport Route Plan Manual may be used. Moreover, if possibly, more research should be done to determine the cause of the yielded actual operating numbers of PUJs. The researchers suspect that the reason of it is related to the viability of profit, for it is the only parameter that was not covered in this study.

As for the comparison of mini-buses and PUJs, more study should be done on which mode is more efficient for the consolidated UP-Philcoa route when the PUV modernization scheme is strictly implemented. A traffic simulation of the two scenarios, if possible, is suggested to be produced to further compare and evaluate the two alternatives.

6.2 Use of Study

The yielded results on the estimated required units are recommended to be followed when the new PUV modernization scheme is implemented to supply sufficient amount of PUVs that would cater the served passenger demand. The range and value of results per mode of transportation are already provided wherein a probable distribution of units per hour could be designed based on it. Moreover, the results of the study could be used in designing the local route plan of UP Diliman in accordance with the Local Public Transport Route Plan Manual.

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APPENDIX

Estimation of Unit Requirement for Weekend Variation

1. Utilization Rate

Table 1. Utilization rate of jeepney routes

Routes	Operating Units	Registered Units	UR
UP-Philcoa	10	30	0.333
UP-North EDSA	31	40	0.775
UP-Pantranco	39	77	0.506

Average Utilization Rate: 0.53

2. Viable Load Factor

Table 2. Passenger load factor per route

Routes	Passenger Load Factor, %
UP-Philcoa	69.28
UP-North EDSA	72.63
UP-Pantranco	48.14
Average	63.35

3. Number of Round-Trips

Number of round-trips in an hour:1.5

4. Number of Required PUV Units

Table 3. Parameters for the estimation of required units

Parameters	Values
Utilization Rate	0.85
Viable Load Factor	0.60
Average Seating Capacity	22 (PUJ)
Number of Round-Trips	1.5 (per hour)

Table 4. Peak-hour analysis results for PUJs

Peak Hours		pphpd	Peak pphpd	No. of Units
AM	6-7 AM	227	671	40
	7-8 AM	630		
	8-9 AM	671		
NN	11 AM-12 PM	354	601	36
	12-1 PM	523		
	1-2 PM	601		
PM	4-5 PM	797	797	48
	5-6 PM	538		
	6-7 PM	549		