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**THE LEVEL OF SERVICE OF BUS SYSTEM IN UNIVERSITI
PUTRA MALAYSIA**

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Abstract

This paper focuses on assessing the level of service (LOS) of bus system offered at Universiti Putra Malaysia (UPM) campus. The rapid growth of infrastructure development within the campus has resulted in high concentration of people and high traffic volume. As an institution that put major emphasis on transportation plan to achieve sustainable campus mobility, it is important for UPM to implement the green transport policies with prioritizing public vehicles as the main mode. This would also support UN Sustainable Development Goals and create a greener campus environment. However, the existing bus system provided in UPM faces the issue of connectivity and mobility affecting the level of satisfaction among users that requires a mitigation measure to improve. Thus, the assessment of Level of Service (LOS) was conducted by using the qualitative and quantitative methods to identify level of satisfaction among users. The LOS assessment was employed on the aspects of fixed-route hour service, fixed-route service frequency, passengers' thresholds and speed of buses. Furthermore, the onboard survey was conducted to evaluate the satisfaction level among users. The results suggested that whilst the bus services levels are less than those aspired by the passengers, there are many improvement areas to be prioritized in the near future for a more sustainable transportation system in the university.

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Keywords: Level of Service (LOS), university bus service, sustainable campus mobility.



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1. Introduction

The high concentration of people and high traffic movement in UPM campus is due to the growth of campus population causing by university development. UPM as one of the leading higher learning institution in Malaysia has unique transportation needs and comprehensive transportation plan to achieve more sustainable campus mobility. The university aims to be a greener campus in term of transportation environment, thus, creating a modal shift away from the automobile is essential, and implementation of transport policy become more practical and coincides. Recently, there has been an increasing trend in the usage of motorized-vehicle as a primary mode of transportation for both students and staff in the university. According to Khorasani and Zeyun (2014), students are the direct recipients of the service provided by the university. The high numbers of population in campus will increase the need of student mobility (Khorasani & Zeyun, 2014). For example, in UPM itself the total number of population for both undergraduate and postgraduate students were 24 874 where most of the students tend to use bus services provided by the university. Hence it is vital to ensure the acceptable Level of Service (LOS) of university bus is achieved.

1.1. Level of Service (LOS)

Rather than using the quantitative measures of students' views, quality services also can be evaluated through qualitative approach of Level of Service (LOS) measures (Transportation Research Board, 2003). LOS could be applied in assessing the bus service performance to improve the quality, reliability, efficiency and effectiveness of the system (Zakiah, 2016).

1.2. The Student's Satisfaction

In normal practice of passengers' satisfaction level surveys, attributes such as waiting time, reliability, service information, comfort, travel time, convenience, safety, security, affordability and frequency of service are assessed (Ismail, Hafezi, Nor, & Ambak, 2012). The key component to know the satisfaction of passengers that will influence level of satisfaction on bus services include traffic supply, reliability and information, bus stop and bus design for comfort and enjoyment of passengers; staff skills, attitude and knowledge when dealing with passengers and safety issues (Fellsson & Friman, 2008).

2. Problem Statement

Generally, four main problems are identified in this research which bring gap towards the level of satisfaction among the students while using the bus in UPM.

2.1. The Quality of Bus Services at UPM

The performance of bus affects directly the level of service and safety to the students. No study has been done at UPM to identify the quality of bus services. The quality of service refers to the level of comfort during travel/ride, average network speed, and waiting time, walking distance to bus stop, journey times and reliability (Khorasani & Zeyun, 2014).

2.2. Assessment of Level Bus Services in UPM

In general, Malaysia public transport services are below the traveller's expectation (Rohana, Ismah, & Anizalana, 2012). The current performance of bus services in UPM should be evaluated in order to know the efficiency and also effectiveness for the students' need.

2.3. Low Level of Services Delivery

Poor quality of bus services will cause students to miss classes, waste time and discourage them to ride the bus services as at the same time due to discomfort such as tardiness of bus, unpleasant rides, issues on safety and unsupportive bus personnel (Hashim, Mohamad, Haron, Hassan, & Hassan, 2013).

2.4. Green Transportation System in University

The provisions to use campus bus services will help to ensure the greener environment through the reduction in private car users which usually caused congestion at the entrances and exits and along the campus roads (Rugayah, Shireen, Sabariah, & Fariah, 2013). This will help to reduce carbon footprint tremendously when the bus services is operated with a green concept (Rugayah et al., 2013), Greening the campus should be a shared responsibility where all stakeholders should take an active part in environmental care where one of the aspect was bus services.

3. Research Questions

The research questions employed in this study are:

- What are the Level of Services (LOS) for bus services in Universiti Putra Malaysia (UPM)?
- How the students' perceive bus services quality and performance?

4. Purpose of the Study

The purpose of this research is to study the performance of bus services delivery in UPM. The objectives of this research are:

- To assess the Level of Services (LOS) of bus services delivery in Universiti Putra Malaysia (UPM).
- To identify the students' satisfaction of bus services delivery in Universiti Putra Malaysia (UPM).

5. Research Methods

5.1. Sampling Techniques and Strategies

Convenience sampling was employed at Universiti Putra Malaysia, Serdang, Selangor where N = 400 respondent from the total number of students 24,874.

5.2. On-Board Survey and Observation

Questionnaire was developed to identify passengers' satisfaction and aspiration survey during the onboard survey. The questionnaire consists of four (4) parts which are general information, level of

student’s satisfaction, level of bus service in UPM and the user aspiration. The on-board survey is conducted where the researcher was seated near to the front door. The questionnaire distributed during peak hours where the first trip is between 8.00 am to 10.00 am (morning peak), 12.00 pm to 2.00 pm (afternoon peak) and lastly 4.30 pm to 6.00 pm (evening peak). The observation took place at ten (10) bus stops in UPM.

5.3. Adaptation Level of Service (LOS) Measuring Quality Standard

The LOS assessment for fixed-route hour of service, frequency and bus speed were conducted using the adaptation of standard measurement in Table 01, 02 and 03.

Table 01. Fixed-route hour of service LOS

LOS	Hours of service	Remarks
A	19-24	Night “owl” service provided
B	17-18	Late evening service provided
C	14-16	Early evening service provided
D	12-13	Daytime service provided
E	4 – 11	Peak hour service only or limited midday service
F	0 – 3	Very limited or no service

Source: (Noorfakhriah & Madzlan, 2011)

Table 02. Fixed-route service frequency LOS

LOS	Average Headway (Min)	Vehicle per Hour	Remarks
A	< 10	>6	Passengers do not need schedule
B	10-14	5-6	Frequent service, passengers consult schedule
C	15-20	3-4	Maximum desirable time to wait if bus/train missed
D	21-30	2	Service unattractive to choose riders
E	31-60	1	Service available during the hour
F	>60	<1	Service unattractive to all riders

Source: (Noorfakhriah & Madzlan, 2011)

Table 03. Bus speed LOS

LOS	Speed (km/h)	Adapted from Ministry of Urban Development India (n.d)	Adapted from Cortes, Gibson, Gschwender, Munizagag & Zuniga, (2011)
A	>30	Primarily free flow movement at average travel speeds usually about 70% of the free flow speed for the key corridors	Excellent
B	<25 to ≤30	Small increase in traffic causing substantial increase in approach delay and hence, decrease in arterial speed	Good
C	<21 to ≤25		Fair
D	<19 to ≤21	Significant approach delays and average travel speed of 1/3 the free flow speed or lower. Such conditions causing combination of one or more reasons such as high signal density, extensive queuing at critical intersections and inappropriate signal timing	Barely acceptable
E	<15 to ≤19	Key corridors at extremely low speeds below 1/3 to 1/4 of the free flow speed. Intersection congestion is likely at critical signalized locations, with high approach delays.	Bad
F	≤15		Very bad

Source: cited in (Zakiah, 2016)

6. Findings

6.1. Demographic Profile of Respondent

Table 04 showed the distribution of questionnaire among the gender where male consists of 18.3% and female 81.8%. The differences in percentage among male and female were due the high number of captive riders being female passengers who lack access to other mode of transportation for example private vehicles (Krizek, Newport, White, & Townsed, 2007; Zakiah, 2016). Besides that, Noorfakhriah and Madzlan (2011) state that due the common behavior of male passengers that have high tendency not to respond towards the onboard survey compared to female.

Table 04. Gender distribution

Gender	Frequency	Percentage (%)	Differences in %
Male	73	18.3	Female > Male
Female	327	81.8	
Total	400	100.0	

Table 6 showed that most of the students tend to use bus services less than 5 times a week (43.3%) as only 6.5% of students used bus more than 16 times a week. The high number of users within the range less than 5 times a week was due to the location of the faculty. Each class was located within the walking distance and adjacently which make students tend to walk rather than waiting for the bus. In summary, UPM students tend to use bus services in order to reach educational nodes most of the time (Zakiah, 2016).

Table 05. The Frequency Users of Bus by Students

Frequency Use of Bus	Frequency	Percentage (%)
< 5 times	221	55.3
6 – 10 times	108	27.0
11 – 15 times	45	11.3
> 16 times	26	6.5
Total	400	100.0

6.2. Trip Characteristic

Table 7 shows the respondents trip distribution during the semester. Through the findings, students tend to use bus services to reach their faculty had the highest number of users 80.5% due to the factor such as to going to the classes, appointments with the lecturers and most of the programmes held at the faculty itself. Second highest destination that becomes the main reason why student used bus as their main transportation was residential college, 60.5% where most of the students stayed within the campus especially first year students. As for the least popular destination among the students to reach by using bus was Banquet Hall (6.5%) because of the isolated location of the building with the main academic area and longer waiting time for bus services.

Table 06. Respondents destination distribution

Destination	Yes		No	
	Frequency	%	Frequency	%
Faculty	322	80.5	78	19.5
Library	223	55.8	177	44.3
Stadium	62	15.5	328	84.5
Putra Food Court	124	31.0	276	69.0
Pusat Kesihatan Universiti	76	19.0	324	81.0
Banquet Hall	26	6.5	374	93.5
College	242	60.5	158	39.5
Others	27	6.8	373	93.3

Table 07 present the results indicating that the highest waiting time was between 11 to 20 minutes, 39.0%. This was due to the number of bus provided by UPM had been reduced recently. The waiting time become longer because of the overcrowded users during peak hours rushing to classes.

Table 07. Waiting time at the bus stop

Times	Frequency	Percentage (%)
< 10 minutes	115	28.8
11 – 20 minutes	156	39.0
21 – 30 minutes	106	26.5
> 31 minutes	23	5.8
Total	400	100.0

Table 08 shows that the average time taken for the journey of bus to reach destination was below than 10 minutes (50.8%). Time consuming was in the lowest state due to the systematic traffic management especially during peak hours. As for the least percentage was 0.5% (more than 30 minutes) due to certain circumstances such as accidents or events held in the campus that cause traffic congestion.

Table 08. Average time take for the journey of bus

Times	Frequency	Percentage (%)
< 10 minutes	203	50.8
11 – 20 minutes	159	39.8
21 – 30 minutes	36	9.0
> 31 minutes	2	0.5
Total	400	100.0

6.3. Level of Service (LOS) Bus Services

6.3.1. Fixed – Route Hours Services

From the study, the fixed-route hour services provided in UPM during weekdays and weekend operation hours are between C, D and E for 8 different routes (Table 09).

Table 09. Fixed-route hour services of bus services

Routes	Weekday		Weekend	
	Operation Hours	LOS	Operation Hours	LOS
K5/KTP/KPZ/K13 – academic area	16 hours	C	16 hours 30 minutes	C
K12/K14/K16/KMR – academic area	16 hours	C	16 hours 30 minutes	C
K10/11 – academic area	15 hours	C	15 hours	C
K17 – academic area	15 hours	C	15 hours	C
KTP/K12/13/14/15/16/KMR – Agrobio Complex Faculty of Agriculture	13 hours 15 minutes	D	12 hours 15 minutes	D
K12/14/15/16/KMR – Graduate School Office & Food Complex	9 hours 45 minutes	E	N.A	N.A
South City Plaza/Serdang Commuter – UPM	15 hours 15 minutes	C	15 hours 15 minutes	C
International Housing Complex & Infroport	11 hours 15 minutes	E	N.A	N.A

Source: Secondary Data from Time Schedule for UPM Bus Services Session 2017/2018, UPM Student Affairs Division

Note: N.A = Not Available

The longest operation hours were from Kolej Canselor/Kolej Tun Perak/Kolej Pendeta Za’ba/ Kolej 13 to the Academic Area and from K12/K14/K16/KMR to the Academic Area with service operation are 16 hours in the weekday and 16 hours 30 minutes during the weekend. The shortest operation hours were from K12/K13/K14/K15/K16/KMR to Graduate School Office and food complex where the operation hours 9 hour and 45 minutes which available in weekday only. Overall, bus service hours in UPM was between the LOS C (highest) and LOS E (lowest) that involve two service routes which are 1) Graduate School Office and Food Complex and 2) International Housing Complex and Infoport. Most of service routes provided in UPM were within the acceptable level of LOS D. Only two bus routes had the longest operation hours due to high demand from the students as at the same time the location of these two places was at the center of college resident’s.

6.3.2. Fixed – Route Hours Services

Table 10 showed that the less frequent of bus services was for route South City Plaza/ Serdang Commuter to UPM and International Housing Complex and Infroport with the frequency of more than 60 minutes and measured as LOS F. As for the most frequent number of service was for route K12/K14/K16/KMR to the Academic Area with 10 minutes frequency and measured as LOS B.

Table 10. Fixed-route service frequency

Bus Routes	Weekday		Weekend	
	Service Frequency	LOS	Service Frequency	LOS
K5/KTP/KPZ/K13 – academic area	15 minutes	C	30 minutes	D
K12/K14/K16/KMR – academic area	10 minutes	B	30 minutes	D
K10/11 – academic area	45 – 60 minutes	E	45 – 60 minutes	E
K17 – academic area	60 minutes	E	60 minutes	E
KTP/K12/13/14/15/16/KMR – Agrobio Complex Faculty of Agriculture	30 minutes	D	60 minutes	E
K12/14/15/16/KMR – Graduate School Office & Food Complex	45 minutes	E	N.A	N.A
South City Plaza/Serdang Commuter – UPM	> 60 minutes	F	> 60 minutes	F

International Housing Complex & Infroport	> 60 minutes	F	NA	N.A
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6.3.3. Average Journey of Bus Speed

Table 11 shows the average journey bus speed for six (6) service routes was below 50 km/h. The maximum average had been recorded was 29km/h and the lowest average of speed was 15km/h. Two bus routes had the LOS E below the acceptable range (LOS D) while only two routes are identified with the LOS B.

Table 11. Average journey of bus speed

Route	Trip Distance (km)	Travel Time (mins)	Average Speed (km/h)	LOS
K5/KTP/KPZ/K13 To Academic Area	5.53	18	19	D
K12/K14/K16/KMR To Academic Area	4.26	10	26	B
Kolej 10/11 To Academic Area	4.14	17	15	E
Kolej 17 To Academic Area	6.96	18	23	C
Ktp/Kolej 12/13/14/15/16/Kmr To Agrobio Complexfaculty Of Agriculture	4.06	9	29	B
South City Plaza (Academia) / Serdang Comuter Station To Upm	7.68	30	15	E

6.4. Student’s Satisfaction Level toward Level of Bus Services

About 42.0% of the students were satisfied with the level of services provided by the bus in UPM. Only 2.8% states that there were extremely dissatisfied with the services which may due to longer waiting time, the attitude of bus drivers and the limited number of bus. Table 12 shows the evidence of satisfaction level among the students as the main users of bus in UPM.

Table 12. Level of student’s satisfaction

Level of Satisfaction	Frequency	Percentage (%)
Extremely Dissatisfied	11	2.8
Dissatisfied	30	7.5
Moderately	136	34.0
Satisfied	168	42.0
Extremely Satisfied	55	13.8

Spearman Correlation test (Table 13) had been conducted in order to identify the relationship of student’s satisfaction with the level of bus services in UPM.

Table 13. Spearman Correlation Analysis

		Level of Student’s Satisfaction	Level of Bus Service
Level of Student’s Satisfaction	Correlation Coefficient	1.000	.303
	Sig. (2 tailed)	.	.000
	N	400	400
Level of Bus Service	Correlation coefficient	.303	1.000
	Sig. (2 tailed)	.000	.

	N	400	400
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The result of spearman correlation show that there is a weak positive relationship between the level of student's satisfaction and level of bus services in UPM ($r = .303, p < .05$). The correlation between the two variables indicates the association between the levels of students' satisfaction with the level of bus service provided.

7. Conclusion

This study had come out with the analysis of level of service (LOS) and student's satisfaction that consider several aspects such as waiting time, frequency of bus, bus speed and convenience that related with bus services. Very weak correlation between student's satisfaction and level of bus service indicates the need to improve the current bus services. Good quality of bus service can be achieved through regular assessment of LOS and passenger's satisfaction surveys.

There are several recommendations could be done in order to solve the issues which influenced the performance of bus.

- Introduce Transportation Management Programmes

This programme or policy will responsible to all transportation planning in UPM especially regarding bus services. Every semester this programme should conduct a survey in order to identify the satisfaction level of students who use bus services within and outside the campus.

- Monitoring Strategy (Routes, Frequency and Operation)

The Transportation Advisory Board should come out with the monitoring strategy regularly especially regarding the aspects of routes, frequency and operation. By installing GPS tracker it will help the board to identify the performance of bus for the better improvement in the future.

- Increase the Number of Bus and Routes

Due to high population of students in UPM thus, it is really important to increase the number of bus especially at the centre of college's residents during peak hours. One of the UPM initiatives was by introducing "pink bus" only for female students' policy. Several research and survey need to be considered by the administration before come out with the suitable number of bus needed.

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