A Geographical Assessment of Travel Patterns of Commuters between their Residences and Dagon University

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Abstract

The study investigated travels of the commuters between their residences and Dagon University within the area of Yangon City to identify travel demand, travel patterns and to suggest smooth transportation facilities and services. The analysis is based on commute data of teachers, students and staff at Dagon University. This study emphasizes public transport of Dagon University; questionnaire, interview and survey were done for the analysis. The sources of data were structured questionnaire which were obtained from Yangon Region Bus Control Committee (Ma-Hta-Tha). The sampling procedure entailed the identification of the motor park, selection of the passengers, in order to obtain the relevant data in accordance with the structured questionnaire. It was found that the most of the buses met on Pyihtaungsu Road; the travel characteristics of passengers revealed that time was not directly proportionate to distance; and the highest level of traffic congestion can be found in downtown area and gradually decreased to peripheral area. The passengers face the challenges of public transport such as traffic congestion, transit, frequent stops, unexpected breakdown of vehicles, leak of rain from the bus roof, noise of engine, overcrowding, no refund and more charge of bus fare. The government needs to consider these implementations: Traffic signal synchronization, HOV lanes, single-entry traffic corridor, BRT system, MRT system (Mass Rapid Transit), using waterway (Yangon River, Pazuntaung Creek and Ngamoeyeik Creek) and building rail route (two-storey overpass).

Key words: Geographical analysis, public transport, travel patterns, terminal, Dagon University

Introduction

Due to the expansion of urban areas, most of the universities in Yangon are located in the new towns, for example, Dagon University, East Yangon University and West Yangon University are found in peripheral area. Teachers, students and staff always take a long way to commute between their homes and these Universities. Dagon University, which is located in Dagon Myothit (East) Township, has the largest number of students in Myanmar. Consequently, it demands more facilities of public transport than other universities although it is not very far from downtown area rather than other universities. Whatever may be, the government supports public transport for commuters and Dagon University is the only one university in Yangon which has a parking place for public transport.

Table 1 is the sampling frame for half of 1235 (618) questionnaires; this represented the total number of respondents (passengers) who used public transport. The sampling technique used for this study is the purposive sampling method because it lacked of pre-determined consistent population and there was no choice for passengers. The sampling procedure entailed the identification of the motor park, the passengers' choice of the buses at the motor park, and the interview, and the survey using a structured questionnaire. The study was conducted on passengers; a sample size of 618 questionnaires was achieved and bus line supervisors were interviewed; and simple descriptive methods were used for data analysis.

Geographical Background of Study Area

Dagon University, which was established in 1993, is located in Dagon Myothit (East) Township, Yangon City (Figure 1) and its area is about 1,600 acres. In the year of this study (AY 2013-2014), there were 17,712 day students, 1095 teachers and 534 staff.

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Table 1. Number of Vehicles and Passengers

No.	Bus-line	Types of passenger vehicle	Number of daily buses' Travels	Average daily passengers per car (to & from university)	Average daily passengers (to & from university)
1	No. 49	Dyna	8	80	640
2	No. 174	bus	38	150	5700
3	No. 202 (Special)	Special bus	9	170	1530
4	No. 202	bus	21	150	3150
5	No. 213 (Special)	Special bus	33	150	4950
6	No. 235	Mini bus	48	75	3600
7	No. 245	Mini bus	30	75	2250
8	No. 255	Mini bus	27	75	2025
9	Aungtheikdi	Special bus	9	160	1440
10	Adipadi	Special bus	46	150	6900
Total			269	1235	32185

[Source: Opened interview (January, 2014)]

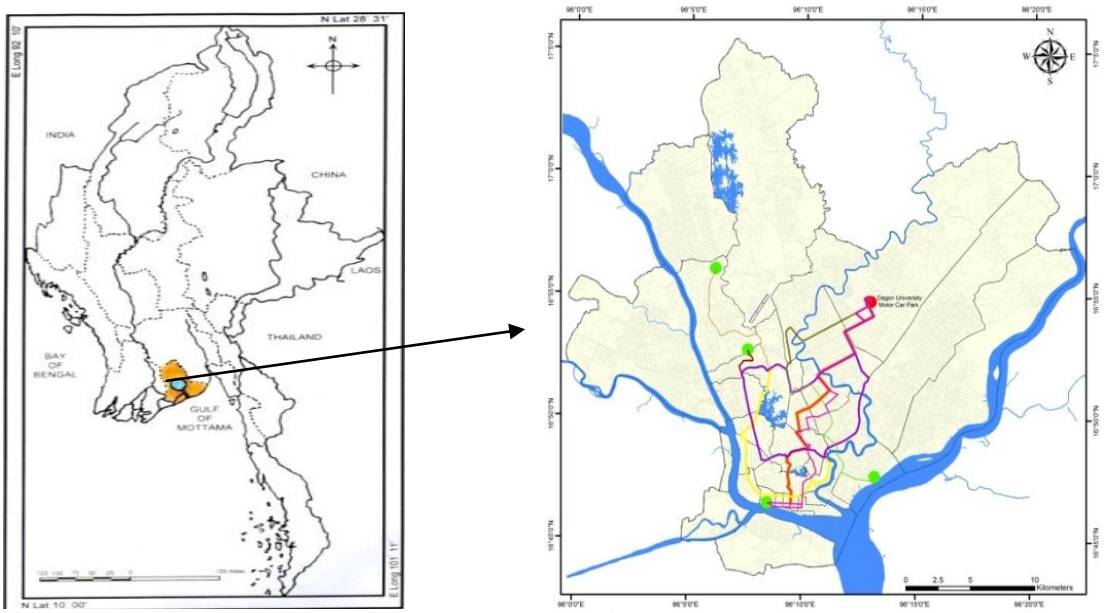

Figure 1. Location of Dagon University (Source: Myanmar Survey Department)

Bus terminal which was initiated in 1995 is situated in the eastern part of the Dagon University campus. There are nine bus stops on the campus (Plate 1).

The park is operated under the joint-supervision of Central Supervisory Committee for Motor Vehicles and Vessels (Ma-Hta-Tha) from Yangon Region and Campus Department of Safety and Security from Dagon University. According to the survey, there were 366 buses from ten bus lines, operating in the park, and carrying 32,185 passengers per day.

Historical Background of Transportation in Dagon University

The transportation of Dagon University was initially arranged with two ferries (Hilux) in line with the schedule. The ferries operated between seven-eight junction of Dagon Myothit (East) and Dagon University. When the university opened, 70% of the students took a ferry between their residences and the university due to cheap fare (75 kyats per month but

depending on distance). Ferry fare was increased to 600-1200 kyats in 1999-2000 and again to 3000-4000 kyats in 2005. As a result, 60% of ferry commuters decreased and the number of bus lines increased in 2006. However, 221 special ferries have been used for commuters during peak hours (7:30-9:00 am and 1:00-4:00 pm) (U Zaw Lwin, 2006).

Rail transport was introduced on March 4th, 2006, and train travelled nine times daily, carrying over 1600 passengers per day (up and down). The number of passengers decreased to 300 on account of the increase in train fare from 10 kyats to 100 kyats in 2013.

Travel-to-Work Patterns

The unique character of this study was journey to work (JTW): the commuters left home for the same destination, Dagon University. There were various transport patterns in the study area: walking, cycling, motor cycling, taking a private car, a bus, a train, a taxi and a ferry. They were grouped into two kinds of JTW transportation type used in this study: the former is private transport (walking, cycling, motor cycling and taking a car) and the latter comprises public transport (taking a bus, a train, a taxi and a ferry) between the residences and the destination, Dagon University.

Commuters chose transport pattern with a focus on spatial differences. The purpose of travel-to-work figure was to analyse transport patterns: distance and social context were important factors in choosing the transport patterns of commuters in Dagon University. Figure 2 represents commuting distance from Dagon University, creating concentric circles and each circle refers to a specific travel pattern.

Walking or cycling: Generally, a pedestrian could walk or cycle at 5 km per hour. The space/time relationship of such a commute would be a circle of 10 km diameter (Rodrigue, 2009). The commuters living near or at the Dagon University Campus could walk or cycle to reach university.

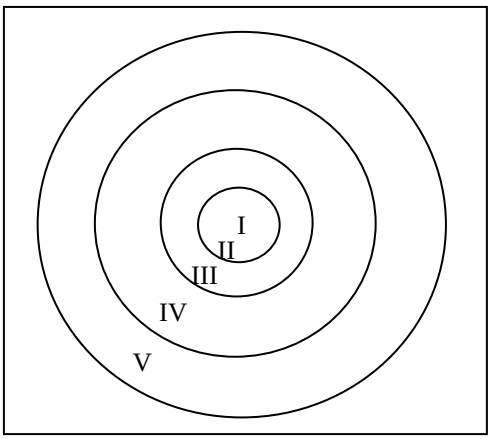

Figure 2. Travel-to-work pattern of Dagon University

Motor cycling or taking bus: A motor cycle could travel between 5 and 10 km to work and could not travel more than 10 km around Dagon University according to traffic rules. Therefore, most of the commuters took a bus to get to their destination.

Train, bus or private car: The train could offer high capacity (a significant number of people) and cheap fare, but there might be delay when compared with car. The commuters (students) faced this problem when they used train. The majority of commuters living within 10-15 km travelled by bus, but only a few in their cars.

Bus or ferry: The commuters who lived within the area of 15 and 33 km between their homes and destination took a bus or ferry. Generally, the commuters who did not get direct access to

Dagon University went by ferry. The commuters waited for the ferry at a specific point because it did not serve door to door system.

Ferry: The distant commuters (35-45 km) used only ferry because they did not have any other alternative travel pattern to the destination. The commuters often took the taxi between their homes and Dagon University if they were in a hurry especially during exam period.

Transportation System of Dagon University Terminal

Commuters to Dagon University have become increasingly dependent on the public transport (bus) system between their homes and Dagon University. The focus of the study is the bus system to Dagon University pattern. Developing transport system has been a continuous challenge to facilitate transportation of commuters, to satisfy mobility needs, and to support human resource development.

Table 2. Number of vehicles in Dagon University Terminal

No.	Bus-line	Types of passenger vehicle	Total number of buses	Number of buses'daily travels	*Average daily passengers per bus (to & from university)
1	No. 49	Dyna	12	8	80
2	No. 174	bus	56	38	150
3	No. 202 (Special)	Special bus	10	9	170
4	No. 202	bus	30	21	150
5	No. 213 (Special)	Special bus	33	33	170
6	No. 235	Mini bus	74	48	75
7	No. 245	Mini bus	36	30	75
8	No. 255	Mini bus	45	27	75
9	Aungtheikdi (Special)	Special bus	12	9	170
10	Adipadi (Special)	Special bus	58	46	170
	Total		**366**	**269**	**1285**

Source: Yangon Region Central Supervisory Committee for Motor Vehicles and Vessels (Ma-Hta-Tha)
*Interview (January, 2014)

Vehicle routing

There are two kinds of bus line at Dagon University Bus Terminal: circular bus line (No. 174, No. 213 Special, and Adipati Special bus lines) and linear bus line (No. 49, No. 202, No. 202 Special, No. 235, No. 245, No. 255 and Aungtheikdi Special bus lines). And there are two main public transport routes from Dagon University: Bomhu Bahtoo Road – North Okkalapa in/ from the western part of the university, and Min Ye Kyaw Swa Road in/ from the southwestern part of the university. Of these two routes, the second route branches off to Pinlon Street – South Okkalapa and another goes on Pyihtaungsu Road to Thuwana at Ma-Wa-Ta Junction (Figure 2). No. 202, No. 202 (Special) and No. 49 buses run along Bomhu Bahtoo Road and pass through North Okkalapa. No. 202 and No. 202 (Special) buses pass 8-mile and No. 49 bus runs Kabaraye–South Okkalapa–Thingangyun–Thaketa after crossing North Okkalapa Bridge.

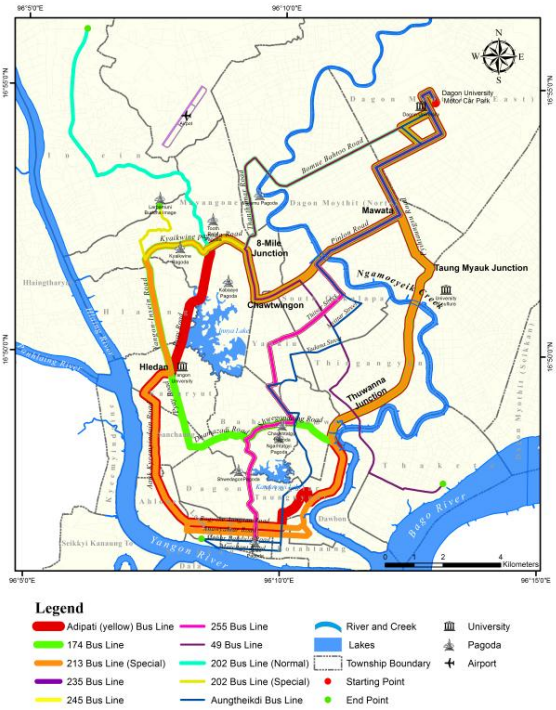

Figure 2. The routes of ten bus lines to Dagon University

Source: Yangon Region Central Supervisory Committee for Motor Vehicles and Vessels (Ma-Hta-Tha)

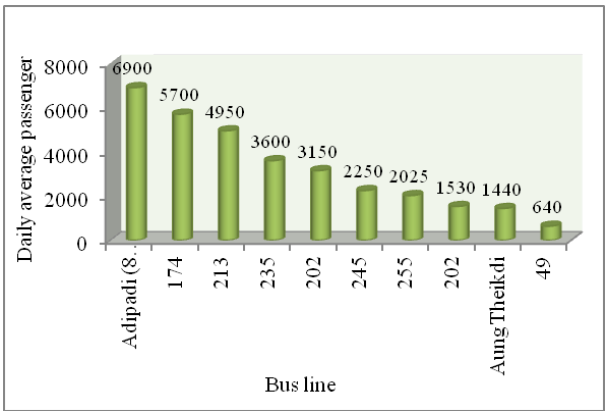

Figure 3. Average daily passengers in ten bus lines

Source: interview (January, 2014)

No. 174, No. 213 (Special), No. 235, No. 245, No. 255, Adipati (yellow) and Aungtheikdi buses start from the southwestern part of Dagon University and run through Minyekyawswa Road and through South Okkalapa, Mayangone, and they separately run after crossing Bayli Bridge. No. 174 follows Kamayut, Myaynigone, Bahan, Tarmway, Thuwanna North Dagon Myothit, and terminates at Dagon University. No. 213 (Special) 8-mile and Adipati (Yellow) bus lines run on Thamine–Insein Road and Pyay Road respectively. They meet at Hledan after passing Kyeemyindaing, Ahlone, Lanmadaw, Latha, Pabedan, Kyauktada, Pazundon, Thuwunna, Thinkangyun, Dagon Myothit (South) and terminate at Dagon University Terminal.

Network flow and distribution

The average daily passenger flow of bus line ranges from 640 to 6900 in the study area (Figure 3). The degree of flows is shown in thin or thick lines with the amount of average daily passengers (Figure 2). Most of the buses meet especially on Pinlon Road. Adipati (yellow) 8-miles, Aungtheikdi, No. 213 (Special) 8-miles, No. 174, No. 235, No. 245 and No. 255 bus lines altogether 7 buses from 7 bus lines meet on Pinlon Road after passing Bayli Bridge. According to the interview, they carried 20,940 passengers (65%) along Pinlon Road. Therefore the journey on Pinlon Road is shown in the thickest line in figure 2. It highlights the degree of traffic flow. Adipati (yellow) Thuwunna, No. 174 and No. 213 (Special) Thuwunna bus lines flow on Thanthumar Road with 11,625 persons (36%). Accordingly, passenger flow along these routes was moderate high.

According to the number of buses per day, Adipadi bus line carried the highest number of passengers with 6900 persons and No. 174 with 5700 persons was the second highest in ten bus lines. The bus lines which transported the least number of passengers were No. 202

(special) bus line with 1530 persons, Aungtheikdi bus line with 1440 and No. 49 bus line with 640.

Table 3 and Figure 4 show the number of passengers towards Dagon University in peak hour (from 8:45 a.m. to 9:15 a.m.). Adipati (yellow) 8-miles bus line could transport about 38 percent of total passengers. This bus line was the highest number of buses with 58 buses and could release 46 buses per day to Dagon University. Therefore this line could catch 20 buses on 8-miles Route and Thuwanna Route in rush hour. Some passengers (17%) on 8-mile route and Thuwanna route used 8 buses of No. 213 (Special) bus line in rush hour. This bus line had 33 buses and the number of buses per day was 33 buses. About 4 % of passengers were transported by No. 235 bus line with four buses.

Table 3. Commuters of Ten Bus Lines towards Dagon University in Rush Hour

Bus line	No. of passengers in rush hour	No. of buses
Adipadi (8 miles)	1800	20
No. 213	720	8
No. 174	350	5
No. 202	350	5
No. 49	315	9
No. 255	300	6
Aung Theikdi	270	3
No. 245	250	5
No. 202	220	4
No.(235	200	4
total	4775	69

Source: Interview (January, 2014)

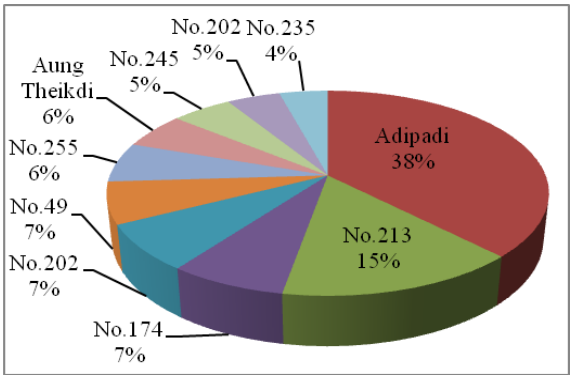

Figure 4. Commuters of ten bus lines towards Dagon University in rush hour
Source: Interview (January, 2014)

Travel Characteristics of Passengers in Dagon University

The ideal transport mode would be instantaneous, free, have an unlimited capacity and always be available (Rodrigue, Comtois & Slack, 2009). Transport performs space with time and money.

Generally, driving time varies by road distance in a network. Table 4 expresses that the shortest road distance is found in No.174 bus line compared with the rest of bus lines. The driving time took 3 hours and 20 minutes. The second shortest road distance could be found in No. 202 (Special) bus line but the driving time 2 hours and 10 minutes was the lowest among ten bus lines. On the other hand, the longest road distance could be found in Aungtheikdi bus line while driving time is the longest among ten bus lines. Therefore, driving time does not always depend on the distance; it is particularly found in urban transportation. The urban transportation was impeded by congestion and traffic light.

Table 4. Driving Time of Ten Bus Lines

No.	Bus line	Distance (km)	Driving Time
1	No. 174	42.80	3 h 20 min
2	No. 202 (Special)	43.04	2 h 10 min
3	No. 235	47.32	3 h 50 min
4	No. 245	47.32	3 h 50 min
5	No. 255	47.32	3 h 50 min
6	No. 202 (Normal)	49.90	2 h 30 min
7	Adipadi (yellow)	50.66	3 h 10 min
8	No. 49	52.84	3 h 10 min
9	No. 213	54.88	3 h 18 min
10	Aungtheikdi	65.12	4 h 00 min

Source: field survey on 12th June, 2014.

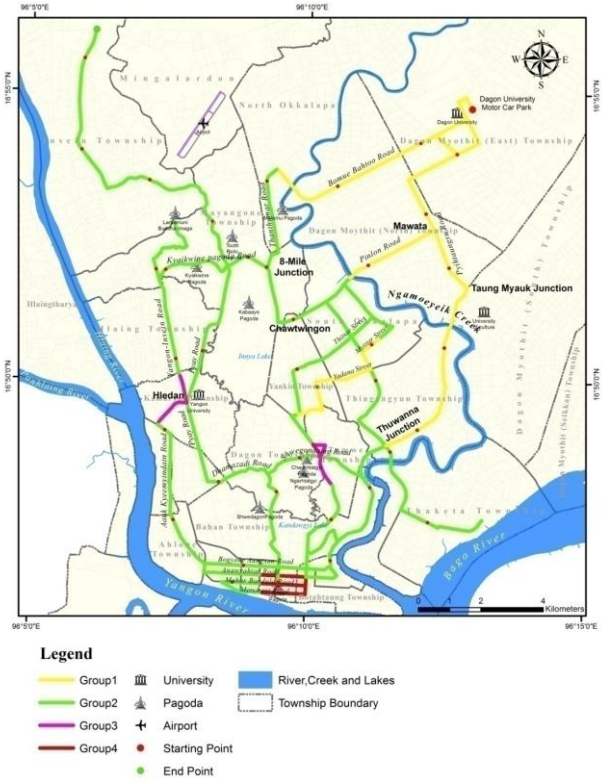

Figure 5. Driving time among 4 groups of public transport
Source: field survey on 12th June, 2014.

Relationship between date and time

Based Distance often tends to be interchanged with time when measuring the performance of transport systems, which is a conceptual error (Rodrigue, Comtois & Slack, 2009). While distance remains constant, time can vary due to improvements in transport technology (positive effect), because of congestion (negative effect) or regulations such as speed limits. A simple common way to express this relationship is speed: the unit of distance travel per unit of time. Driving three kilometres through downtown area (from Bo Aung Kyaw Road to Shwedagon Pagoda Road) is not the same as driving three kilometres through Dagon Myothit (North) even if in both cases the same unit of distance has been traveled. Distance is thus a uniform attribute of geography, while time is relative. On the transport network (Figure 5), while distance is a uniform attribute, each segment has a travel time expressed as speed which varies greatly from distance due to congestion and traffic light. The time includes get-on and get-off of passengers at bus stops.

Based on the nature of urban public transport, driving time on 3 kilometres of ten bus lines in the study area could be classified into four groups:

1. Group 1 (less than 10 minutes of driving time)
2. Group 2 (between 10 minutes and 20 minutes of driving time)
3. Group 3 (between 21 minutes and 30 minutes of driving time)
4. Group 4 (above 30 minutes of driving time)

Relationship between distance and time is shown in Table 5 and Figure 5. In group No. 1, the driving time in Dagon Myothit (North), Kyaukkonegwe and North Okkalapa Circle is

under 10 minutes. In group 2, it took between 10 and 20 minutes for driving 3 kilometres through Thuwanna Junction, Bone Hospital, Bayli Bridge, Lanmadaw, Ahlone, Thamyine Junction, Shwepazun and Mawtin Junction, SSC, Thuwanna Junction, Chawtwingon- Zawana, South Oakala Pagoda-Moekaung, 8-mile Junction, Mingalarzay and Yuzana Plaza.

In group 3, driving time between 21 and 30 minutes could be found at Tamwe Circle and Heldan due to traffic light. In group 4, it was the longest driving time on 3 kilometres in downtown area. The traffic congestion (above 30 minutes) experiences along Anawrahta Road, Mahar Bandoola Road and Merchant Road between Boaung Kyaw Road and Shwedagon Pagoda Road.

Table 5. Public transport driving time use on survey date

Group	Driving Time	Route
Group 1 (<10 min)	5	Dagon Myothit (North)
	6	Dagon Myothit (North)
	7	Dagon Myothit (North), Kyaukkonegwe,
	9	North Okkalapa Circle
Group 2 (10-20 min)	10	Thuwanna Juction
	11	Disabled Hospital
	12	Bayli Bridge, Lanmadaw, Ahlone
	13	Thamaing Junction
	14	Shwepazun and Mawtin Junction
	15	SSC, Thuwanna Junction, Chawtwingone- Zawana, South Oakala Pagoda, Moekaung
	18	8-mile Junction
	19	Mingalarzay, Yuzana Plaza
Group 3 (21-30 min)	23	Tamwe Circle
	25	Hledan
Group 4 (>30 min)	35	downtown area (from Bo Aung Kyaw Road to Shwedagon Pagoda Road)

Source: field survey on 12th June, 2014.

Challenges of Ten Bus Lines at Dagon University Terminal

Public transportation motor car park is located in Dagon University. However, the number of problems excoriated by Dagon University Public Transport was innumerable and they were also complex; one of the most significant is urban mobility. Public transport of Dagon University problems includes traffic congestion, waiting time for bus, traffic congestion and transit at the bus stop.

Passengers' challenges

Passengers' waiting time for bus

Passenger's waiting time for bus is one of the greatest challenges along their journey. It is related to traffic congestion on account of fixed schedules from Dagon University Terminal. It is shown in Table 6 that, 133 (18%) of the respondents waited for the buses less than 10 min before they caught the bus, 313 (51%) of the respondents waited between 10 to 15 min, 95 (15%) waited between 16 to 20 min, 3 (1%) of the respondents waited between 21 to 25 min and 95 (15%) respondents waited between 26 to 30 min.

Table 6. Passengers' Waiting Time for Bus

Waiting Time for respondents (min)	Bus line	Frequency	Percentage
>10	No. 174, Adipati (yellow)	113	18
10 - 15	No. 202 (Special), No. 213 (Special), Adipati (yellow), No. 235, No. 245, No. 255	313	51
16 - 20	No. 202, Aungtheikdi	95	15
21 - 25	Aungtheikdi	3	1
26 - 30	No. 213 (Special), No. 49	95	15
Total		619	100

Source: Structure interview

Passengers did not wait for Adipati Bus a long time. The bus runs every 5 or 10 minutes due to the largest number of buses in ten bus line (46 buses). No. 213 (Special) bus usually comes 15 minutes per car but sometimes it delays due to Hledan and 8-mile Junction traffic light. Therefore, passengers wait for No. 213 (Special) bus line for 30 minutes at bus stop in rush hour.

Traffic congestion

Increasing road congestion affects buses even more than cars. Drivers slowed down the speed of buses since buses operate along fixed routes unlike private car and taxi.

Table 7. Public transport speed

No.	Bus line	Speed (min/km)
1	No. 202 (Normal)	3
2	No. 202 (Special)	3
3	No. 49	4
4	No. 213 (Special)	4
5	Aung Theikdi	4
6	Adipadi (yellow)	4
7	No. 174	5
8	No. 235	5
9	No. 245	5
10	No. 255	5

Source: field survey on 12th June, 2014.

Decreased speed of buses causes passengers more emotional stress. The driving rate varies according to bus line routes in transport system. Table 7 shows that the fastest speed with 3 minutes is found in No. 202 (Special) and No. 202 bus lines compared with the rest of bus lines. Adipati (yellow), Aungtheikdi, No. 49 and No. 213 (Special) bus lines take 4 minutes per kilometre while No. 174, No. 235, No. 245 and No. 255 bus lines run 5 minutes per kilometre on the fixed routes.

Transit

Although there are various bus lines to reach Dagon University, commuters chose their own access to public transportation. Public transit is often perceived as insufficient transportation for specific areas, notably Mingaladon, North Okkalapa, Thinganguun and Dagon Myothit (South). Obviously Mingaladon Township with 1522 students did not have direct public transport to Dagon University. They went to university by taking at least two transits or three transits when they were in a hurry. Transit passengers of North Okkalapa (especially northern Okkalapa) were the highest number of students with 2155 who found it inconvenient due to No.202 (Special), No.202 and No.49 bus lines passing through the

southernmost part of North Okkalapa. The commuters living around Laydaungkan Road, Thingangyun Township had to transit because any bus line passes on this road to reach university. The passengers who live in Dagon Myothit (South) (1608 students) had to transit for the bus lines run on a few southwestern boundary of Dagon Myothit (South). It is found that the impacts of transit are mounting costs and travel time although the transit area is not so far from their homes to university.

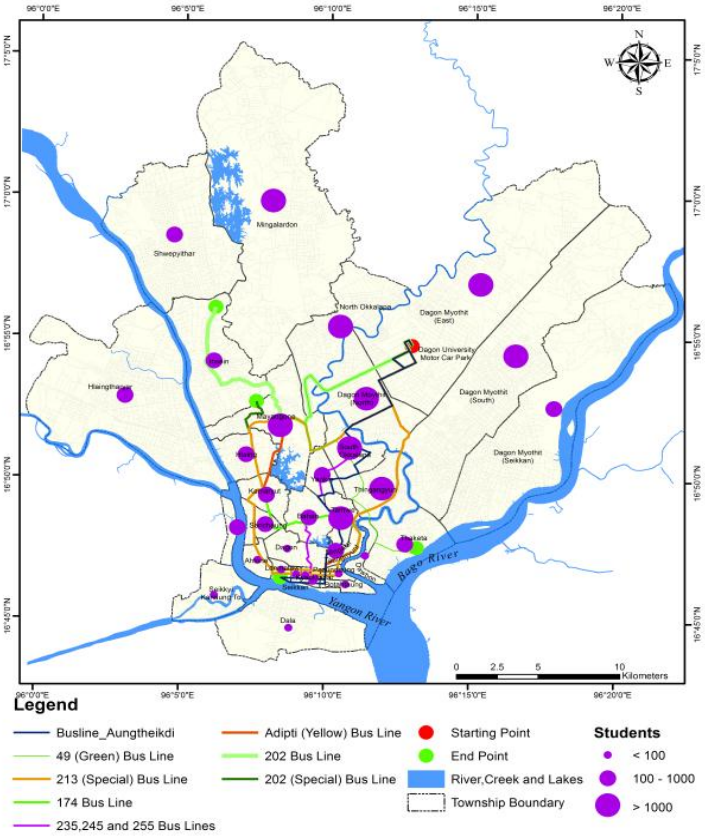

Figure 6. Comparison of public transport with distribution of students
Source: Yangon Region Central Supervisory Committee for Motor Vehicles and Vessels (Ma-Hta-Tha) Student Affair, Dagon University

Poor facilities

Facilities and services given by some of buses in Dagon University bus lines failed to meet the standard, for example, leak from bus roof, unexpected breakdown of vehicles on the route, frequent stops, loud noise of engine, overcrowding, no refund and more charge of bus fare.

Public transport choice

Public transport should provide more accurate estimation of demand trends for Dagon University's commuters and public transport services. When the commuters selected the bus line to reach Dagon University, some used only one type of transport due to preference.

Choosing the bus between their homes and Dagon University was generally based on the assumption that all commuters trade off means of travel between journey time and transport cost.

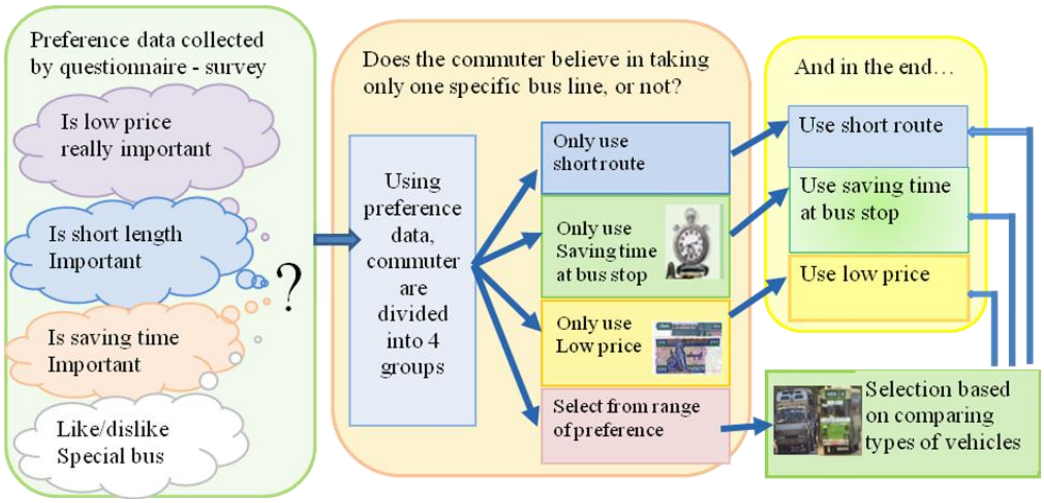

Figure 7. Outline of public transport choice

Consequently, a questionnaire-survey was carried out, based on ten competing bus lines for journeys of 2-40 km. On the basis of preference data collected, respondents were placed into two groups depending on whether they had a preference for only one bus line or not, and the respondent selected travel means from an array of competing bus line route, comparing journey time and price. The latter approach was developed into a two stage decision-making new transport mode choice (Figure 7).

When commuters chose bus lines between their homes and Dagon University they also made a balance between journey time and route length.

Competition among public transport on same routes

Buses on the same route were always competed to get passengers but passengers' choices were different up to their options. Their choices mainly depend on the distance between their homes and Dagon University.

Origin (20–35 km): The commuters chose No. 213 (Special) bus line rather than Adipati bus line due to short route, skilled driving and respect to passengers. Adipati bus line has often unexpected breakdown, longer distance (through Mingalar Market) than No. 213 (Special) bus line.

Intermediacy (10-19 km): The passengers wanted to save time at bus stop that start from *Zaylay* bus stop near Chicken-duck market on Thanthumar Road. The bus lines of No.174 from Tarmwe Circle, Adipati from Mingalar Market and No.213 (Special) bus line from downtown meet at *Zaylay* bus stop. The passengers took whichever bus they saw at bus stop. Therefore the operators usually were in a competition among three bus lines to get passengers.

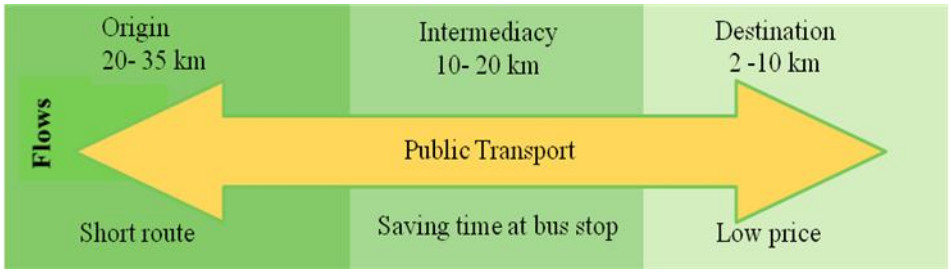

Figure 8. Impacts of distance on public transport choice

Destination (2-9 km): The passengers usually chose No. 174 bus line than other bus lines for low fare at seven-eight junction. The bus lines of No. 213 (Special), No. 235, No. 245, No.

255, Adipati and Aungtheikdi had different elasticity of bus fare, and it may eventually fall, particularly the location which is near to the university. Bus fare decreased from 200 kyats to 100 kyats at seven-eight junction which is the transit point in Dagon Myothit (North) Township. The transport cost was the same as No.174 bus line. This place is very near to Dagon University.

The respondents preferred Aungtheikdi and they did not choose Adipati, No. 235, No. 245 and No. 255 when these buses were at the same bus stop. No. 235, No. 245, No. 255 bus lines are uncomfortable and noisy due to engine as well as the conductors are unsociable. The passengers chose Aungtheikdi bus line but this bus line has only 9 buses.

Three bus lines namely No. 49, No.202 (Special) and No. 202 bus lines have competed along Bomhu Bahtoo Road between Dagon University and North Okkalapa Circle. The passengers had a desire to take No. 49 bus but others dislike it because the kind of vehicle is dyna which is uncomfortable and unsafe for the passengers.

Results

Among three main roads of Dagon University, the highest transport of distribution system can be found on Pinlon Road. On this road, Adipati (yellow) 8-mile, Aungtheikdi, No. 213 (Special) 8-mile, No.174, No. 235, No. 245 and No. 255 bus lines overlapped in seven times with 18,090 persons (56%). Thanthumar Road is moderate high with Adipati (yellow) Thuwunna, No.174 Thuwunna and No. 213 Thuwunna bus lines transport 8,775 persons (27%). No. 49, No. 202 Special and Normal bus lines flow on Bomhu Bahtoo Road in the thinnest passenger flow with 640 persons (2%).

Travel time is not directly proportionate to distance: it is particularly found in urban transportation. The urban transportation was impeded by congestion and block of traffic light. The highest level of traffic congestion can be found in downtown area and it gradually decreases in peripheral area.

The commuters experience challenges of public transport such as traffic congestion, transit, rain, unexpected breakdown of vehicles, frequent stops, noise of engine, overcrowding, no refund and more charge of bus fare.

Discussion and Conclusion

There are two routes from Dagon University to commuters' homes: Dagon University-North Okkalapa Route, and Dagon University- South Okkalapa Route. The highest distribution system can be found on Pinlon Road, Thanthumar Road is moderate high and the least is on Bomhu Bahtoo Road.

Generally, driving time varies in road distance in terms of travel characteristics. Based on the nature of urban public transport, driving time for 3 kilometres of ten bus lines in the study area were classified into four groups. The highest level of traffic congestion can be found in downtown area and gradually decreased to peripheral area.

Most of the commuters used public transport between their homes and Dagon University. They faced challenges of public transport such as traffic congestion, transit, heavy rain, unexpected breakdown of vehicles, frequent stops, noise of engine, overcrowd, no refund and more charge. Most of the passengers have to stand for at least part of the journey, however, some invariably have to stand throughout the journey. The commuters complained that they were very uncomfortable about sitting on narrow-space seats of buses and sometimes the bus drivers accelerated the buses quickly without noticing danger.

Suggestion

To address these challenges, No.49, No.235, No.245 and No.255 bus are to be substituted with standard vehicles, and Adipati buses with new buses due to frequently unexpected breakdown. Central Supervisory Committee for Motor Vehicles and Vessels (Ma-Hta-Tha) from Yangon Region need to train operators to be skillful and conductors to be polite.

Some passengers avoid travelling on congested road. They did not take origin route to save time especially on the way to home (to avoid downtown area). So the bus line of Dagon University–North Okkalapa–8-mile–Pyay Road–Sule is needed for commuters of Dagon University. The transit passengers hope for direct bus lines. The passengers, who have to take transit, mostly depend on ferry; but they want to take public transport. Currently to cope with challenges Adipati bus line should be continued Tharmwe Market to Laydaungkan Road and convergence on old route at *Cargyi Gate* bus stop because most of the teachers, students, and staff live in that area. Some of the bus lines should run through North Okkalapa Township, Mingalardon Township, Dagon Myothit (South) Township to Dagon University.

A few ways can help alleviate congestion to some extent: Traffic signal synchronization, HOV lanes, single-entry traffic corridor, BRT system, MRT system (Mass Rapid Transit), using waterway (Yangon River, Pazuntaung Creek and Ngamoeyeik Creek) and building rail route (two-storey overpass). All these measures may partially address the issue of congestion; they may alleviate, but not solve all the problems. The authority-concerned should seriously implement the bus priority scheme, e.g. bus lanes effectively and efficiently to promote the quality of bus lines.

Yangon City should be integrated with overall land use planning, aiming to develop a good road network and public transportation system in order to overcome the constraints of the transportation system. If decision makers or developers solve these problems, passengers' challenges will be alleviated and urban mobility will be smooth in the near future.

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Mokewa Gate (Entrance of Dagon University)

Circle bus stop (towards Dagon University)

Ten-Mile bus stop (towards Dagon University)

Ten-Mile bus stop (from Dagon University)

Near-office bus stop (towards Dagon University)

Near-office bus stop (from Dagon University)

Plate 1. Bus stops and motor car park in Dagon University Campus
Date: 14.1.14

No. 36 bus stop (towards Dagon University)

No. 37 bus stop (towards Dagon University)

No. 35 bus stop (towards Dagon University)

Dagon University Terminal

Plate 1 (Contd.) Bus stops and motor car park in Dagon University Campus
Date: 14.1.14