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Classification of Bus Driving Behaviour In Universiti Malaysia Sabah Campus

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ABSTRACT

Driving behaviour has been studied by numerous researchers for the past few years. It includes the instantaneous driving behaviour observations and the drivers speed which are said to be influenced by many factors, such as the demographic measure of the drivers, environmental, passenger effect, and road characteristics. This paper describes the recent analysis and classification of driver behaviour in actual driving scenarios among the bus drivers in Universiti Malaysia Sabah (UMS) Main Campus, Kota Kinabalu. This research focussed on determining the riderships of bus in UMS campus, to investigate the differences of instantaneous driving behaviours of bus drivers during the acceleration phase when leaving bus stops, and to produce the classification of the bus driving behaviour in UMS based on the driver's accelerations. In order to achieve the objective of this study, observations were made for determining the riderships and the differences in instantaneous bus driving behaviour several times for each bus stops. For drivers speed and accelerations, a mobile applications called Speedometer GPS was used to obtain the data. Interview was conducted to a total number of 10 respondents to obtain their demographic measure. The results obtained shows the ridership of UMS bus is the highest in the afternoon peak. The instantaneous driving behaviour produce the head movement as the highest percentage during peak hour, and inattentive behaviour as the highest during the off peak hour. The bus drivers in UMS were classified as Aggressive and Calm Behaviour Category.

1. INTRODUCTION

Public transport also called mass transit is one of the transportation modes that carry one or usually more than one passenger while traveling. Generally, it is a shared passenger transportation facility that provides mobility to the general public (Todd Litman, 2018).

This industry is mostly run by scheduled system or timetable organized by the public transport organizers or owners. In Malaysia, it has been the second choice of transportation, after the private vehicle (Muhammad Adib, 2010). This public transport, especially bus, is used

mostly by the community from middle-income to poor families to go anywhere the bus can take them.

Public transport, however, faces harsh criticisms due to its poor performance compared to those who prefer to choose the private transport instead of public transport, the issue about bus is always closely related to the issue performance, whether it is in the aspect of passenger's satisfaction, issue of cost, or the irregular schedules.

The study about the driver's driving behaviour has been arising since it is considered as one of the factors that is important related to the aspect of bus performance. Driver behaviour research is defined by (Johnston and Perry, 1980) as the research in which is directed at describing,

classifying, understanding and predicting the various behaviour of the driver in the process of the road transport system.

The objectives of this study are to determine the ridership of bus in UMS campus, to investigate the differences of instantaneous driving behaviours of bus drivers during the acceleration phase when leaving bus stops, and to classify the bus driving behaviour in UMS campus based on the drivers acceleration.

This research was conducted inside the UMS main campus. This study involved the busses, the drivers of the Universiti Malaysia Sabah Busses, the Department of Development and Maintenance of Universiti Malaysia Sabah, and the passengers which is mostly the students and staffs in Universiti Malaysia Sabah.

2. LITERATURE REVIEW

2.1. Public Transport in Malaysia

Public transport system in Malaysia started as a private sector that gains their monetary benefit using buses. The commuter of bus industry depends on the fare box income model while the commuter fares are considered to cover the return of the owner's modal investment. Nevertheless, as the growth of the city is directly proportional to its infrastructure demands, there is an increase in demand of public mobility due to the significant rise in level of infrastructure growth as well as in the economic activities, resulting the cities to be accumulated with active populations.

Due to the rapid urbanization process in Malaysia, for environmental concerns (Anable, 2005), people are also encouraged by the government policy to practice public transportation instead of using their own vehicle to help in minimizing the traffic congestion and emissions (Hwe et al., 2006; Ismail and Hafezi 2011).

According to the American Public Transportation Association (APTA), the public transport has given many benefits to the people in ways that:

- Public Transportation Is a Safer Way to Travel Than by Automobile
- Public Transportation Saves Money
- Public Transportation Reduces Gasoline Consumption and Carbon Footprint
- Public Transportation Enhances Personal Opportunities
- Public Transportation Provides Economic Opportunities

2.2. Public Transport in UMS Campus

Universiti Malaysia Sabah (UMS) owns and operates their own busses for their own students' and staff's needs. The bus provides transport that is available to use for the students and staffs of UMS.

2.3. Bus Driving Behaviour

Generally, in driving behaviour research study, the main component is the human behaviour. There has been many researchers have put their interest in the driving performance and the attitude towards the roads accidents as well as road rage among the private car drivers (Nesbit et al., 2007).

The bus driver behaviour has been studied broadly in various aspects. These include their physical and psychological health, accident involvements, driving performance, and bus fuel consumption. Demographic measure such as age is also correlates with the aggressive driving that relates to safety behaviour (Lancaster and Ward 2002).

A study by Mather (2007) refers to how age influences driving behaviour due to the size of human factors that includes distraction, memory, navigation, targets identification, legibility of street sign, and judgement of collision, affect the cognitive phenomena of driving.

Since there is no specific standard rules that can be applied to classify the driver behaviour particularly in city areas, this study can be very challenging. But, with the proper parameter and measures taken, the driver behaviour can be classified in a proper and easy way. Parameters used to classify the behaviour differ depending on the purpose of the study.

For this study, the acceleration, speed, and time taken were used since these parameters are the most commonly used in driving behaviour study recently. Ericsson in his study in 2005 supported the use of speed as parameter which stated that under real world driving, the driving pattern can be described by many factors such as average speed, average acceleration, average deceleration, mean length of driving period, a number of acceleration-deceleration change etc. Among many factors, the average speed is the most common used variable.

With reference to DeVliegar (2000) in his study, the driver behaviours are classified based on average positive accelerations into three categories which are calm, normal and aggressive driving in urban areas based on

average positive accelerations. Driver who drives between the range of 0.45 – 0.65 ms-2 was classified as calm, 0.65 – 0.80 ms-2 as normal and 0.85 – 1.10 ms-2 as aggressive.

3. METHODOLOGY

Figure 1 shows the flowchart of the methodology conducted in this research.

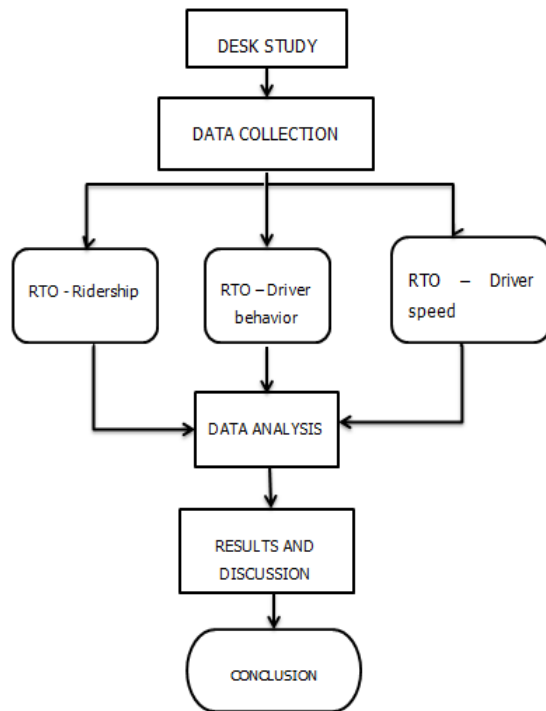


Fig. 1 Flowchat of Methodology

3.1. Desk Study

This is one of the ways to gather and extract information Laptop and libraries are the main source for obtaining broad reference for this study. Laptop was used to access the academic journal, and articles while libraries were visited to gain broad approach regarding this study from the related previous thesis and books.

3.2. Data Collection

Data collection was conducted in the bus station of UMS campus. Ridership was determined by real-time observation; counting the number of passenger loading and unloading the bus. Interview was conducted to a number of 10 respondents regarding their demographic measures. The data for driving behaviour was obtained by monitoring the drivers behaviour when driving. Only

behaviour leaving from a stop is included in the data analysis at such bus stop. At the same time, the driver's speed was recorded using mobile application named Speedometer.

3.3. Classification of Bus Driving Behaviour

Final evaluation was made to 3 drivers based on their complete obtained data. In this approach, driver who drives between the range of 0.45 – 0.65 ms-2 was classified as calm, 0.65 – 0.80 ms-2 as normal and 0.85 – 1.10 ms-2 as aggressive (DeVliegar, 2000).

3.4. Data Analysis

The data collected from all the methods above were presented in table, charts or graphs with the aid of Computer Software such as Microsoft Excel. The results were analysed and interpreted with some supporting references. The speed data of the driver was calculated to in the form of their positive accelerations for further classification.

4. RESULTS AND DISCUSSIONS

4.1. Ridership of Bus in UMS Campus

The result of the bus riderships in UMS is presented in Figure 2.

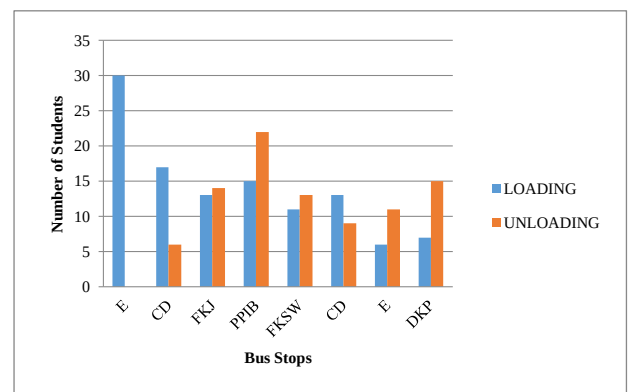


Fig. 2 Average Loading and Unloading Passenger at Each Stops on the Afternoon Peak Hour.

Based on the result shown in Figure 2, in afternoon peak hour, it was found that the highest average loading passenger is at bus stop Kg. E while the highest unloading passenger value is at bus stop PP1B.

The average passengers at each station for the month of February and March are shown in Figure 3 and Figure 4.

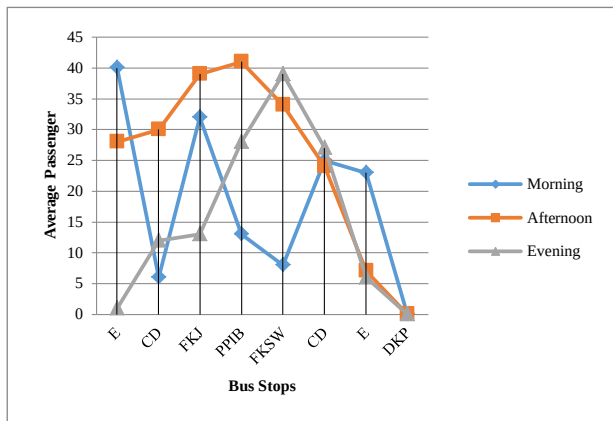


Fig. 3 Average Passenger at each station in February

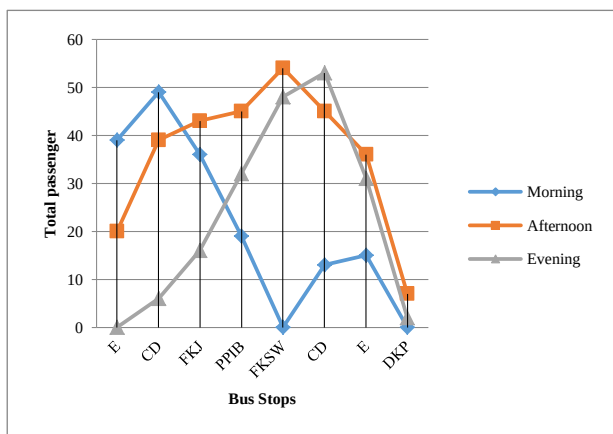


Fig. 4 Average Passenger at each station in March

4.2. Instantaneous Driving Behaviours

Figure 5 and 6 displays the summary of the bus driving behaviour based on the percentage of instantaneous driving behaviour during the peak hours and the off-peak hours.

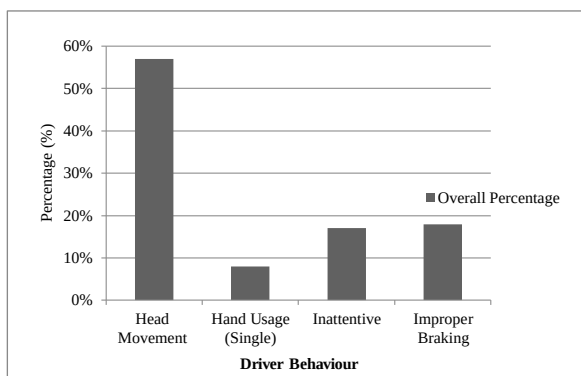


Fig. 5 Percentage of Instantaneous Bus Driving Behaviour during the Peak Hour

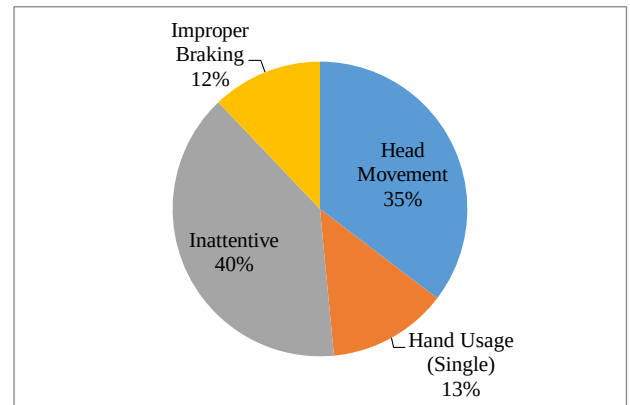


Fig. 6 Percentage of Instantaneous Bus Driving Behaviour during the off Peak Hour

Based on the result, Inattentive behaviour shows the highest value. This result shows different value than the data that was obtained during the peak hours. It shows the changes in driving behaviour with respect to the passenger's, that the drivers during the off peak hours tend to be more inattentive due to the less passenger volume on board. The finding is supported by some studies that indicate the passengers do have influences on the bus driving behaviour (Wahlberg, 2007, Chen et al., 2000).

Classification of Bus Driving Behaviour in terms of Speed and Acceleration.

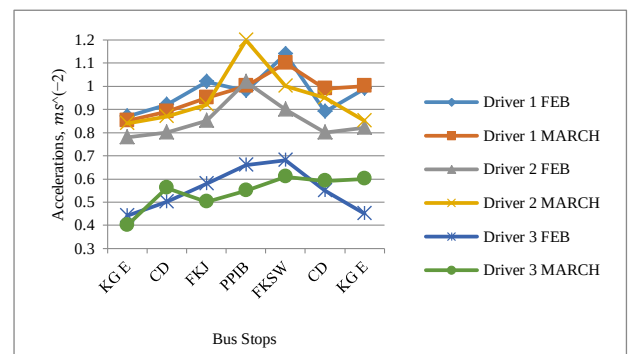


Fig. 7 Average Driver's Positive Accelerations (taken within the t=0s to t=20s after leaving the bus stops)

Figure 7 exhibits the average driver's positive accelerations when leaving the bus stops. Based on the positive accelerations value presented in Figure 7, the February and March data for Driver 1 congregates with the data for Driver 2. Meanwhile, the data for Driver 3 for both months scattered away from that Driver 1 and 2 regions.

For the classification, according to their acceleration range, referring to Table 1, it was shown that the Driver 1 and 2 fall into the Aggressive Behaviour category, while Driver 3 falls into the Calm Behaviour category.

Table 1 Classification of Bus Driving Behaviour

Driver	Average Accelerations Range (ms^{-2})	Driving Behaviour Classification (ms^{-2})
Driver 1	0.85 - 1.14	Aggressive (0.85 – 1.10 ms^{-2})
Driver 2	0.78 - 1.2	Aggressive (0.85 – 1.10 ms^{-2})
Driver 3	0.40 - 0.68	Calm (0.45 – 0.60 ms^{-2})

Based on the Table 2 shown, Driver 1 and Driver 2 are on the category below 50 years old while Driver 3 is on the upper 50 years old category. The variation in accelerations among the drivers may be associated with driver's demographic factors mentioned in several studies by Lancaster and Ward (2002).

Table 2 Demographic Measures

Criteria	Driver 1	Driver 2	Driver 3
Age	35	43	53
Marital Status	Married	Married	Married
Total Driving Experience (years)	16 years	22 years	35 years
Total Bus Driving Experience (years)	10 years	13 years	33 years

Older drivers are more sensitive to the enforcement penalties against traffic violations and has been found to drive the bus less aggressively than those in the group younger than 46 years olds (Andy, 2006) which explains why Driver 1 and 2 have Aggressive Behaviour, and Driver 3 has Calm Behaviour.

5. CONCLUSIONS

The ridership trend of the internal bus in UMS campus shows that high volume of ridership in the peak hour. The afternoon peak hour carries the highest volume of total passenger on board.

The differences in instantaneous driving behaviours of bus drivers during the acceleration phase when leaving bus stops during the peak hours shows that the head movement has the highest percentage as for the off peak bus driving behavior, inattentive shows the highest value.

For the classification of bus driving behaviour, the analysis indicates that among the drivers involved, 66.7% of the bus drivers in UMS Campus are categorised in the Aggressive Behaviour category.

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