



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**COMPARISON STUDY OF NOISE EMISSION TEST OF
DIFFERENT BUS MODEL FROM INTERIOR**

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor's Degree in Mechanical Engineering Technology (Refrigeration and Air-conditioning System) with Honours.

by

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DECLARATION

I hereby, declared this report entitled “Comparison Study of Noise Emission Test of Different Bus Model from Interior” is the results of my own research except as cited in reference.

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APPROVAL

This report is submitted to the Faculty of Mechanical and Manufacturing Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Engineering Technology (Refrigeration and Air Conditioning system) with Honours. The member of supervisory is as follow:

.....
(NOOR SAFFREENA BINTI HAMDAN)

ABSTRACT

Public transportation such as buses plays an important roles in human life nowadays to travel to a desired place. Bus service are one of the variety public transportation that people used the most in their daily life because of the easiness and extensive of the services. Therefore, the comfortness of passengers is one of the important factors to be considered to provide high quality of bus operation service. Noise from bus interior is one of the comfort factor that influence the passengers. This is because the exposure of noise in long term will effect on their health and further effect is induced the hearing problem. Moreover, the awareness regarding noise from bus interior is lacking among people especially people who uses bus service in their daily life. Based on the lack of study regarding bus interior noise, a study is done where survey were conducted to identify the effect and awareness of bus interior noise to the passengers. Noise measurement from bus interior were conducted, where several bus model is selected to identify the noise emission level from bus interior. Sound Level Meter is a measuring equipment used to measure the noise emission level emitted by the source.

DEDICATIONS

I would give this dedications to my beloved parents Jereta Abas and Justin Jiran for giving me a lot of inspiration, encouragement and having faith in me to complete this research. I also want to dedicate Madam Noor Saffreena binti Hamdan as my supervisor who have been a lot of help for me in completing this research.

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CHAPTER 1

INTRODUCTION

1.1 Background study

Nowadays, public transportation is considered as a necessity in human life to travel to a desired place. Public transportation comes in any type of transport such as trains, buses, subways, ferries and many more. Typically most of the type of public transportation used by people in their daily life to travel to nearby places is buses. Buses is one of the oldest public transportation that were introduced to the world due to the need of people to travel to a desired places. Several factors that make buses as one of the most used public transport are due to easiness and extensive of bus system and services. Besides that, public buses gives many benefits not only for the people, but also to the environment in a bigger perspective. Moreover, bus services provide a cheaper fares, help to overcome congestion, ease traffic jam and provides convenient transport for people regardless of people background.

Problem regarding buses that have been a concern as a problem faced by the society is noise problem. Noise problem is a problem that affecting the people and environment but most people is neglecting this problem because of the lack of awareness to this matter. Even though the fact that the vehicle development in global automotive is increasing, the noise generated from the vehicle itself was unavoidable. Typical noise that present in the bus interior consists mainly noise from the engine, pump, drive train, air conditioning noise, road noise and wind noise.

1.2 Problem statement

Noise emission from bus interior is one of the concern problem and it affecting the comfortness of the driver and passenger of the bus. The noise emission from interior give negative impact to the passengers and the bus driver. This is due to the lack of awareness and guidelines of noise emission level that encouraging the noise problem have been neglected. Plus, there a less or lack of study regarding this problem.

1.3 Objectives

- I. To survey noise problem among passengers for bus at idle speed.
- II. To measure and analyse noise emission level from interior at driver's seat, front passenger seat, middle passenger seat and rear passenger seat position with different bus model at idle speed.
- III. To analyse and compare noise emission from interior produce by different bus model.

1.4 Project scope

For this project, different model of bus will be used and noise emission will be measure and compared between the selected bus models. This project will be carried out at Main Campus of University of Technical Malaysia Melaka. Survey form regarding the comfort in bus interior is distribute to passengers to identify how noise from bus interior is effecting their comfort while riding the bus. The data will be taken or measure under 2 condition where first condition is bus engine idle running low and secondly is bus engine idle running high. The noise level will be measure at a several different positions inside of the bus which are driver's seat, front passenger seat , middle passenger seat, and at the rear passenger seats.

For the data of noise level from interior to be taken in 2 condition, a device to measure sound known as the Sound Level Meter (SLM) is use which are the most suitable device to detect and measure noise from the bus interior. The measurement of the noise will be taken before the starting the bus engine and after starting the engine under the 2 condition mention above.

CHAPTER 2

LITERATURE REVIEW

Introduction

This chapter will cover the background of public transportation, the research on bus operation, bus service quality, the explanation on noise and the equipment that will be used in this research.

2.1 Public transportation

Public transportation which are known as public transport, public transit or mass transit is a shared passenger transport service which is for the use by the general public and basically operated on fixed routes, managed on a schedule and each trip will be charge set fares or fee. Public transportation that available to the public are in any forms of transport such as buses, trains, ferries and subways, while public transportation between cities or country is operated by the airlines and coaches. Public transport has been a necessity in human life today. In most of develop countries, public transportation essential to gives the public transportation option to go to work place, go to school, visit friends or to travel to a desired place. Public transportation also benefits the general public and the environment in many ways such as saves fuel, reduces congestion, provides economic opportunities to drives community growth and revitalization, reduces gasoline consumption, reduces carbon footprint and to improve the traffic. In other meaning, public transportation is a way or solution to the world's economic, energy and environmental challenges in helping to bring a better quality of life. For the most part, 'public transport' is a common term dating back, at least, to the provision by states, private owners, and corporations of modes of motorized transport

that could be enjoyed by the broader populace as these became available during the middle and latter part of the Industrial Revolution (Leigh, 2011).

Nowadays, public transportation is one of core components to support the growth sustainability of a developing country. In fact, the reduction of the dependence of motor vehicles is one of the key elements in the management of the urban environment (Abd Rahim & Nor Ghani, 2006). Among the various types of public transport, buses are the most common public transport that used daily by the peoples. Buses operate daily by using streets as medium of travel and have an extensive network of lines. Figure below shows the selected respondent respond to public transportation.

Background	Percent
Gender	
<i>Male</i>	45.1
<i>Female</i>	54.9
Age	
<i>Early Youth (16-19 years)</i>	5.7
<i>Middle Youth (20-25 years)</i>	74.7
<i>Late Youth (26 years)</i>	19.5
Ethnicity	
<i>Malay</i>	36.2
<i>Chinese</i>	33.5
<i>Indian</i>	27.6
<i>Others</i>	2.7
Marital Status	
<i>Single</i>	87.8
<i>Married</i>	12.2
Employment Status	
<i>Working full time</i>	25.9
<i>Student @ HLI</i>	74.1
Importance of Public Transportation	
<i>Important</i>	66.8
<i>Not Important</i>	33.2
Use of public transport	
<i>Yes</i>	99.1
<i>No</i>	0.9
The last use of public transport	
<i>Past 6 month</i>	76.0
<i>Past 1 year</i>	14.7
<i>Past 1 year or more</i>	9.2

Figure 2.1: Distribution of selected respondent profile in respond to Public Transportation.

Source: (Dzuhailmi, 2015)

Based on Figure 2.1 above, a survey was done by Dzuhaulmi, 99.1% of 445 respondents uses public transport and only 0.9% of the respondent do not use public transport (Dzuhailmi, 2015). This shows that public transportation such as bus is crucially important in Malaysia.

2.1.1 Buses

Buses exist in a variety of models, sizes, capacities, types and body types depending on the manufacturer. The main types of bus, which is the most common bus used nowadays is minibus, a regular bus or single deck bus, and double-decker bus. A minibus is in a range of 6-8 metres in length, which has a capacity of 15-40 seats and standing space, and it is used for lightly travelled lines, short shuttle lines and services in residential neighbourhoods. On the other hand, a regular bus or single deck bus has a length of 10-12 metres, 2.5 metres wide and has a capacity of 30-50 seats.



Figure 2.2: Single deck bus
Source: (Pioneer Coachbuilder Sdn Bhd, 2018)

For a greater capacity of passenger, double-decker bus is the type of bus designed for that purpose, where it has two decks, the upper deck and the lower deck. Unlike the regular bus, double-decker can carry more passengers, which is double the capacity of a regular bus, but take a less street space. In this bus type, it involves passengers climbing stairs to the upper deck, which is inconvenient. However, riding on the upper deck offers a nice view for the passengers.

2.2 Bus operation services

Over the world, open transport task plays a crucial part to give transportation to the people who are in needs. Transport administrations are furnished by various transport offices with their own particular points. For example, in Hampshire, UK, it was accounted for that 70% of open transports are worked and keep running by private business organizations while 30% are subsidized completely or incompletely by the Hampshire Nation Committee or by neighborhood area (Munzilah 2013). Transport task benefit relies upon different factors, for example, populace, culture, condition and financial aspects. Transports are by a long shot the most utilized method of open transport because of its adaptability, high accessibility and availability. For instance, in Kuala Lumpur, Malaysia, open transport benefit is regularly favoured because of its less expensive cost and better scope of regions contrasted with different sorts of open transport, for example, prepares and air travel. Open transport activity administrations are keep running at a particular timetable or calendars, which a particular circumstances of take-off and landing are given at waypoints along the course. Despite the fact that that transport activity administrations was focused at a calendar courses and times, these are frequently hard to keep up because of movement clog, breakdowns, startling occurrences, street blockages and terrible climate. Notwithstanding, unsurprising causes that influenced the transport task administrations, for example, morning and night surge hour activity are frequently accounted in the calendars, with the goal that the current timetable can be changed in accordance with overcome the deferrals and holes that happen.

Types of bus operation services are usually planned based on people needs. In addition of special purposes for passenger needs, various types of bus operation services target and become engaging to specific user of groups among the people. Some of the examples with its availability across various countries are listed below:

i) Bus Rapid Transit (BRT)

BRT is a creative and adaptable transport travel framework that is broadly utilized as a part of city territories. The BRT interfaces traveller travel with variety types of public transit, for example, train or tram. It is a quick, productive, protected, low

spending plan and easy to use bus compared to the urban bus systems. The utilization of BRT with incorporated framework and particular vehicle on devoted transport paths can altogether enhance city portability. It has now turned into a worldwide application nowadays. In Europe, BRT is generally used to give a better quality and capability of transportation with viable cost. Be that as it may, in some Asian nations like Malaysia, the utilization of BRT framework is viewed as new and as yet developing.

ii) Express Bus Service

Express transport benefit activity are expected to run quicker than typical transport benefit and is widely utilized for long journeys which utilize the speediest course to achieve goal. Express transport administrations, regularly serve trip designs that have basic birthplaces and goals and in not making the same number of stops as ordinary transport administrations to keep up high travel speeds and level of administration. The transport benefit just stops at committed regions. Contrasted with rail go for long journeys, travel by express bus is substantially less expensive and give more joins not offered by rail systems.

In particular, in a few nations in Europe, express transports are worked on a business premise. In Malaysia, express transports are worked by privately owned businesses, for example, Sani Express, Transnasional Express, and KKKL express on a premise of timetable and unscheduled administrations. Express transports administrations are famous for individual reasons, occasion go amid huge festival occasions, for example, Eid and Chinese New Year. Other than that, Malaysian express transport administrations are likewise utilized for business and working purposes. The activity administration of express transports in Malaysia is accessible 24 hours. A portion of the transport administrations, particularly for long separation venture to every part of the administrations are worked amid week hours.

iii) Shuttle Bus Service

Transport benefit is an administration that utilizations little transports or vans for open versatility. It is utilized for shorter excursions along occupied passageways. The

acquaintance of minibus administrations is with cook for short separation with higher recurrence benefit. In Malaysia minibus is the most prevalent open transport for between cities go in Kuala Lumpur and Klang Valey since it was presented in 1975. With less expensive tolls, a minibus traveller can utilize the administration for boundless separation inside the scope course. Be that as it may, minibus administrations was ended in 1998 and today the administration has been supplanted with a more complex administration under new brand of transport which is the RapidKL. Other than that, different urban areas in various nations, for example, Hong Kong, Buenos Aires, Calcutta (India), Manila (Filipina), Istanbul (Turkey) and Cairo utilize a scaled down transport activity benefit as city carry administrations.

iv) Internal and Private Bus Services – Malaysia

In Malaysia, some organisations operate and own a bus for their own needs and purposes. For example, Universiti Teknikal Malaysia Melaka (UTeM) is one of the public university in Malaysia that provides a unique on-campus bus for private and internal use of its students. The bus service in UTeM is mainly to transport students from university residential areas to their campus, but it is also provides transport to students and the university staffs to attend any event that were held outside of the campus. The bus operation is under the management of The Development and Property Management Office of UTeM, where all matter regarding the bus operation including the bus schedules is all decided through it. The bus is basically free for every students and it is available from 0700hours to 2300hours daily through a fixed routes and time.

v) Tour Bus Service

The tour bus service is one of the services that provided a sightseeing tours for tourists. This bus service is operated by many bus company that comes with many types and design of the bus, where regular buses is usually used as a tour bus but nowadays double decker bus type is the most popular type used as a tour bus in big cities. In Malaysia, a tour bus operation bus service which is known as Executive Bus operated by Transnasiona Express Sdn Bhd Company, provide tour bus operation services for long distance travel.

2.2.1 Bus service quality and human comfort

Service quality are the responds from the user of public transport such as the bus passengers as their satisfaction towards the service. Service quality can be measured in many kinds of parameters and many series of action have been made to meets the passengers requirement and satisfaction towards the service. The service quality of a bus as one of the public transport is an important matter since the many people uses public bus service as their daily transportation. The parameters that usually being mention or concern by the passengers while using the bus are the seat comfortness, the temperature level on the bus, cleanliness of the bus interior (seats and floor), frequency of the bus being on time and the overall service. Traveller comfort is an imperative file that can be utilized to gauge the nature of open transport administrations and an urgent factor in occupants' decision of activity mode (Dell'Olio, 2011). For instance, the personal satisfaction in China has been expanding throughout the years, which thus has prompted the interest for higher lever of trip comfort. In this way, enhancing transport solace to pull in more travellers and further ease activity clog has gotten much consideration from transport administrators and specialists (Zhang, 2014).

Furthermore, illustrating the factors influencing transport comfort levels can enable policymakers to actualize focused on the procedures changes. Lai showed that the apparent esteem dictated by benefit quality decidedly influences general fulfilment, contribution, and behavioural aims (Lai, 2011). Solace is one of the key elements prompting high administration quality and essentially impacts traveller fulfilment with transport travels (Eboli and Mazzulla, 2009). Research on transport solace can be generally partitioned into two classes. The primary involves contemplates on vehicle execution and running status, seeing that they influence traveller comfort, speeding up, snap extent, and vehicle clamour and the second sort incorporates transport working conditions, which is the focal point of the present research. In addition, numerous specialists have examined and demonstrated the significance of traveller stack in deciding comfort for public transportation. Figure below shows the service attribution factors for year 2010 and 2011. Figure below also shows that the service attribution factors are changing from year to year.

Most Important Service Attributes			
<i>2010</i>		<i>2011</i>	
1.	Safety and Security	1.	Waiting time
2.	Travel time	2.	Travel time
3.	Comfort	3.	Reliability

Figure 2.3: Quality service parameters attribution in 2010 and 2011
Source: (Munzilah, 2013)

According to Figure 2.3 above, at year 2010 comfort was one of the most important service attribution factors but it was excluded in year 2011. Noise level of the bus from interior is included in comfort factor, but these factor are often ignored by passengers. This is because there is lack of awareness among passengers towards noise problem.

2.2.2 Noise pollution and awareness

Around the world, there are many types of pollution like water pollution, air pollution, and noise pollution. Source of noise such as from transportation, constructions, industries and human activities are contribute to noise pollution. Noise pollution in other words is a form of air that is an audible unwanted sound or noise that gives a potential threat that can affect human's health. Group of people such as the young and elderly are among the group of people that affected the most by noise pollution. Group of people such as young children are unable to protect their own hearing and rely on their parents to keep them from constant noise exposure, as well as elderly which they may not have the capabilities to protect their hearing if they are disable by mental or have physical illness. Noise pollution is an important issues since it give negative impact to human hearing which it is found highly disturbing.

2.3 Noise

Noise can be defined as the unwanted sound which is a sound with an audible energy that affects or disturbs people daily life. The human hearing are able to responds the changes in sound pressure over a very wide range. Sound can be categories as noise as it becomes unwanted when hinders our speech communication, impedes thinking process, disturbs concentration, obstructs activities and presents a health risk due to hearing damage. However, it is important to know that it is depends on the ear of the listener or hearer to decide whether the sound is a noise or not. For example, a driver of a car is playing a loud music hears no noise, but the person in the traffic behind them feels disturbs by the sound which is a categories as a noise to the other person. The measured units of noise is decibels (dB), which is a logarithmic ratio of the power or intensity of the sound weighted towards and assessed relative to the perception and threshold of human hearing. In this study, noise can be defined as an unwanted sound that affect the comfort of the passengers inside the cabin.

2.3.1 Noise level

Human hearing are capable to receive a wide range of sound level. Human ears can detect from the lowest or softest sound to a level where it cannot withstand the sound and will cause a damage to the hearing. The average of hearing or sound level is up to 140 dB for a normal person. For most people, a life time's continuous exposure to an environmental average noise level of 70 dB will not cause hearing impairment, but any continuous level above 70 dB will affect human hearing ability. For example, an adult person's ear can tolerate an occasional noise level of up to 140 dB, but this is not recommended over a prolonged time period because 140dB is a very high sound level that strong enough to damage human hearing in a long term. Within the range, there are value that indicate for characteristic of a sound level for human hearing. The value of sound level less than 30 dBA is very quiet; 30-60 dBA is quiet; 60-90 dBA is moderately loud; 90-110 dBa is very loud; and 110-130 dBA is uncomfortably loud has been classified by Navajo (Nojavo, 2008). This indicates and shows that the higher the decibels, the higher the noise level. Figure below shows the example of noise level from different types of noise source and the noise evaluation.

Sound Pressure Level (dBA)	Typical Source	Subjective Evaluation
140 130 120 110	Long range gun, gunner's ear Threshold of pain Jet take-off at 100m Night club dance floor	Extremely noisy to intolerable
100 90	Loud car horn at 3 metres Heavy truck at 10m	Very noisy
80 70	Curbside of busy street Car interior	Loud
60 50	Normal conversation at 1m Office noise	Moderate to quiet
40 30	Living room in quiet area Inside bedroom at night	Quiet to very quiet
20	Unoccupied recording studio	Almost silent

Figure 2.4: Noise level from typical sources
Source: (Jane, 2001)