

**THE READINESS OF UMS RESIDENT TO IMPLEMENT
CONGESTION CHARGING IN KOTA KINABALU CITY CENTRE**



FARIQ ISMETH BIN JAIMIN

UMS
UNIVERSITI MALAYSIA SABAH

**FACULTY OF ENGINEERING
UNIVERSITI MALAYSIA SABAH
2020**

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IMPLEMENT CONGESTION CHARGING IN KOTA
KINABALU CITY CENTRE**

FARIQ ISMETH BIN JAIMIN



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Disahkan Oleh,

FARIQ ISMETH BIN JAIMIN
MK1711045T

(Tandatangan Pustakawan)

Tarikh : 15 Oktober 2019

(Dr. Mohd Azizul Bin Ladin)
Penyelia Utama

DECLARATION

I hereby declare that this thesis, submitted to Universiti Malaysia Sabah, for the fulfillment of the requirement for the Master of Engineering, has not been submitted to any other university for any master's degree. I also certify that the work described herein is entirely my own, except for quotations and summaries sources of which have been duly acknowledged.

15 October 2019

Fariq Ismeth Bin Jaimin
MK1711045T



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CERTIFICATION

NAME : **FARIQ ISMETH BIN JAIMIN**
Matrik No : **MK1711045T**
TITLE : **THE READINESS OF UMS RESIDENT TO
IMPLEMENT CONGESTION CHARGING IN
KOTA KINABALU CITY CENTRE**
DEGREE : **MASTER OF ENGINEERING**
FIELD : **CIVIL ENGINEERING**
VIVA VOCE DATE : **15 OCTOBER 2019**

 **CERTIFIED BY;**
CO-SUPERVISORY
1. MAIN SUPERVISOR Signature
Dr. Mohd Azizul Bin Ladin

2. CO-SUPERVISOR

Dr. Nor Sheena Herayani Binti Harith

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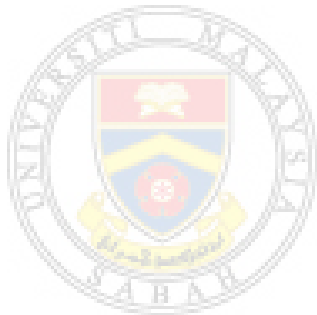


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ABSTRACT

Kota Kinabalu is a developing city on the West Coast of Sabah which is facing the consequences of the exponential increase in population and motorisation. As more vehicles are on the road, so does the severity of the congestion. This causes a chain reaction that not only will damage the city's traffic flow but will inevitably cause damage to the environment as well. This aims to develop a model based on the readiness of Universiti Malaysia Sabah residents to implement congestion charging in Kota Kinabalu. There are several cities in the world such as London, Milan and, neighbouring Singapore that have successfully implemented the congestion charging system. These cities have also proved that congestion charging can reduce the number of vehicles on the road. A total of 402 respondents were collected using a stated preference survey method within Universiti Malaysia Sabah. From this study, it was discovered that the Singapore model of adjusting price based on the Level of Service and enforcement using RFID technology is the most advanced, and charging based on vehicle emission has a faster diminishing return as discovered in Milan. From the survey data, the model was developed and was revealed that increase in price for the congestion charge does reduce the number of people willing to drive.



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ABSTRAK

KESEDIAAN WARGA UMS DALAM PELAKSANAAN CAJ KESESAKAN DI PUSAT BANDAR KOTA KINABALU

Kota Kinabalu adalah sebuah bandar yang membangun di Pantai Barat Sabah yang menghadapi kesen peningkatan secara eksponen penduduk dan kenderaan. Memandangkan lebih banyak kenderaan berada di astas jalan raya, begitu juga dengan keterukan kesesakan. Ini menyebabkan tindak balas rangkaian yang bukan sahaja akan merosakkan aliran lalu lintas bandar tetapi juga akan menyebabkan kerosakan terhadap alam sekitar. Kajian ini bertujuan untuk membangunkan model berdasarkan kesediaan penduduk Universiti Malaysia Sabah untuk melaksanakan caj kesesakan di Kota Kinabalu. Terdapat beberapa bandar di dunia seperti London, Milan dan Singapura yang telah berjaya melaksanakan sistem pengecasan kesesakan. Kota-kota ini juga membuktikan bahawa pengecasan kesesakan dapat mengurangkan bilangan kenderaan di jalan raya. Sejumlah 402 responden dikumpulkan menggunakan kaedah kaji selidik pilihan yang dinyatakan di Universiti Malaysia Sabah. Dari kajian ini, didapati bahawa model penyesuaian harga Singapura berdasarkan Tahap Perkhidmatan dan penguatkuasaan menggunakan teknologi RFID adalah yang paling maju, dan pengecasan berdasarkan pelepasan kenderaan mempunyai pulangan berkurangan yang lebih cepat seperti yang ditemui di Milan. Dari data kaji selidik, model telah dibangunkan dan didapati bahawa kenaikan harga untuk caj kesesakan mengurangkan jumlah orang yang bersedia memandu.



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LIST OF SYMBOLS

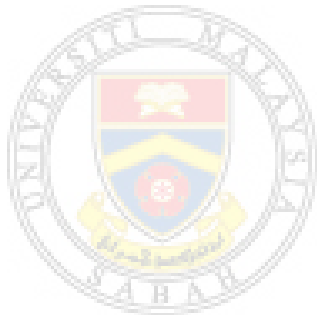
X^2	-	Pearson's cumulative test statistics (Chi-Squared Value)
O_i	-	Number of observation of type i
N	-	Number of observation
E_i	-	Number of expected count of type i
P_i	-	Number of expected count of type i
n	-	Number of cells in the table
P	-	Probability
x	-	Independent variable
α	-	Coefficient to be calibrated
D	-	Constant
N	-	Population Size
e	-	Margin of error
z	-	z-score

LIST OF ABBREVIATION

ALS	-	Area Licensing Scheme
ANPR	-	Automatic Number Plate Recognition
BC	-	Black Carbon
CBD	-	Central Business District
CCZ	-	Congestion Charging Zone
CO	-	Carbon Monoxide
ERP	-	Electronic Road Pricing
IU	-	In-vehicle Unit
MAA	-	Malaysia Automotive Association
MIROS	-	Malaysian Institute of Road Safety Research
MRT	-	Mass Rapid Transit
NASA	-	National Aeronautics and Space Administration
NHTSA	-	U.S National Highway Traffic Safety Administration
NYC	-	New York City
RFID	-	Radio-frequency identification
RP	-	Revealed Preference
RTA	-	Roads and Traffic Authority
RZ	-	Restricted Zone
SP	-	Stated Preference
TfL	-	Transport for London
UMS	-	Universiti Malaysia Sabah
ZTL	-	Zona Traffico Limitato

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CHAPTER 1

INTRODUCTION

1.1 Overview

Malaysia has seen rapid growth in population within the past few decades. This population growth has led to an increase in traffic volume throughout Malaysia. According to the Nielsen Global Survey of Automotive Demand (2014), Malaysia is the third highest globally with 93% of household possessing a car. Other Southeast Asian countries such as Indonesia and the Philippines only boast 54% and 53% respectively. In the same study, Malaysia has the highest frequency of multiple car ownership globally, with 54% of households possessing more than one car. 85% of Malaysia stated that the primary purpose of car ownership is for daily commuting.

In Kota Kinabalu, the number of cars has grown exponentially in the past few years. It can be seen that the number of vehicles owned by each household in Kota Kinabalu is likely to be directly proportional to the number of people driving in the household. There are several factors that could lead to the increase in the number of households owning multiple cars. One of which is the inefficiency of the public transport system. The public transport system in Kota Kinabalu is currently not on par with the current development of the city. Using the current public transport system in Kota Kinabalu, commuters can only choose between the local Mini Bus, for commuting into the city, and City Bus for commuting within the city. Therefore, most commuters prefer to use their vehicle rather than using the public transport available. According to a study conducted by Mohammad and Shakir (2013), most people prefer to use their vehicle as it offers the convenience, comfort, speed, and freedom that public transport does not.

Table 1.1: Number of New Cars Registered

Year	Number of Passenger Cars Registered
2014	588,348
2015	591,275
2016	514,594
2017	514,675
2018	533,202

Source: Malaysian Automotive Association (2018)

Table 1.1 show the number of private vehicles registered in Malaysia recorded by the Malaysian Automotive Association (MAA). According to the data shown, there is an increase of vehicle registered in 2015, 2017, and 2018. There was a sharp drop of 13% in 2016, then it steadily increases by 0.2% in 2017 and 3.6% in 2018. Although statistically, it can be seen as there is a sharp drop in 2016, assuming that all vehicle since 2014 is on the road, the five years total of all new cars registered is a staggering 2,742,094. Such a high volume of vehicles will definitely lead to severe traffic problems such as road congestion and accident. This is true no matter where, as long as there are roads and motorist.

Table 1.2: Number of Road Accidents

Year	Road Accidents
2013	901,823
2014	886,343
2015	894,274
2016	960,569
2017	802,523

Source: Ministry of Transport Malaysia (2018)

According to the Ministry of Transport Malaysia, as shown in Table 1.2, the number of accidents since 2013 is between 802,523 to 960,569. In 2016, the numbers of road accidents increased by 7.41%.

Road accidents in generally result in an adverse effect economically, socially and also to the health of the victim. In the event of an accident, the most common injuries suffered by the victim driving a car is a concussion. While victims on motorcycle, cyclist and pedestrians will suffer more body injuries as they have less protection as compared to car drivers. There are two types of disability that could happen as the result of a traffic accident, temporary disability, or permanent disability. Temporary disability refers to the deterioration of life quality, mentally or physically but with a prospect of recovery. While permanent disability is defined as the loss of life quality, mentally or physically that would restrict the victim for life (Ayuso et al., 2016).

Accidents can cause life-changing events in a blink of an eye not only to the victims but to the victim's close family and friends too. Having to cope with a significantly different lifestyle, such as taking care of the victim, or even worst, having to go through the loss of a loved one, which is taxing both physically and mentally. Victims can also feel cheated, dissatisfied, or hatred towards their own life and others. In extreme cases, it could lead to thoughts and attempts in suicide. Not only the victim is affected, but their close relatives are also exposed to the traumatic experience that causes a sudden change in life. The loss of life of a close relative could drive them towards social isolation. Being in social isolation is stressful as the person has less opportunity to vent out the frustration built up and has a feeling of lacking in support (Másilková, 2017).

Economically, road accidents can cause a tremendous amount of damage. In the U.S, motor vehicle crashes have amounted to almost 1 Trillion Dollars in 2010, according to the U.S National Highway Traffic Safety Administration (NHTSA). About \$277 Billion was lost in the actual cost of an accident, while another \$594 Billion was towards the loss of life, pain, and decreased life quality. Among the \$277 Billion lost are \$93 Billion in productivity, \$76 Billion in property damages, \$35 Billion in medical expenses, and \$28 Billion in traffic-related congestions.

The leading cause of traffic accidents is distraction, as well as recklessness. Accidents caused by drunk driving cost as much as \$199 Billion in actual cost and the loss of life quality. Crashes due to speeding accounted for almost \$210 Billion. The proper use of seatbelts prevented as much as \$69 Billion in damages including medical bills, productivity, and direct cost to the crash while failure to use seatbelts has caused a \$72 Billion in losses.

1.2 Problem Statement

The growing number of private vehicle usage in Kota Kinabalu has led to the increase of road congestion every year. Although using a private vehicle has its advantages, like a double-edged sword, it also has its disadvantages. Some of these shortcomings not only affect the commuters themselves but at the same time, it is also damaging to the environment.

Each car that is being used personally on the road will contribute to the ever increasing traffic congestion issue. Using a mode of public transport such as bus will significantly reduce the total number of vehicle on the road. A single bus can ferry on average of 20 people while only taking as much as three cars space while on the road. If all 20 of person drives their car, it will amount to 20 cars more on the road. As shown in Figure 1.1, in Figure 1.1 (a) shows the amount of space taken on the road for a bus to ferry a group of people. Figure 1.1 (b) is the space taken by using bicycles, and Figure 1.1 (c) is the space taken by cars to transport these group of people. It can be clearly seen that when compared between bus and cars, the amount of space needed for cars to transport the same group of people is more than the space required by bus.

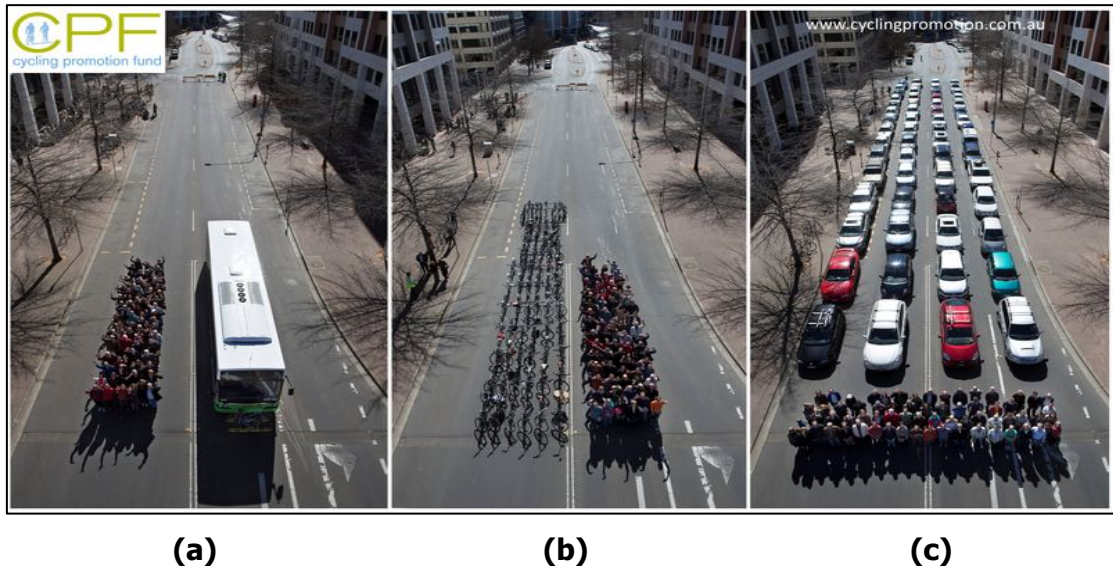


Figure 1.1 : Comparison of Space Used for Different Modes of Transportation

Source : Cycling Promotion Fund (2018)

Having more vehicles on the road causes traffic congestion. Which potentially leads to unpredictable travel time for commuters. Not only that, drivers also experience stress during congestion which often leads to road rage. Although not all drivers that experiences this will lash out and act erratically, it is easy to get stuck in a cycle of emotions where drivers are talking to themselves or think deeply on the traffic condition. Impatience is the main issue to be handle, as it can turn into resentment and anger if not dealt with at the beginning (James & Nahl, 2000). Not only that being stuck in traffic congestion is bad for the health of the commuters, but it is also bad for the health of the environment. Fuels are burnt to keep the car engine running during congestion are wasted fuel, and it affects the person economy as well as hurting the environment.

In 2013, NASA's Goddard Institute for Space Studies in New York released a report on the temperatures around the globe. The institute analyses global surface temperature on an ongoing basis. From the report, it can be seen that the earth surface temperature is rising with each passing year. Scientists emphasize that the weather patterns will always cause fluctuations in average temperature for every

passing year. However, with the continued increase in greenhouse gas emission level in the atmosphere drives the long term rise in global temperature. Each successive years will not necessarily be warmer than the year before, but with the current level of greenhouse gas emissions, scientists predict that each successive decade will be warmer than the previous decade. It is caused by human-made emissions, such as the burning of fossil fuels for energy including combustion engine vehicle.

As such, it is crucial that this problem is solved via a sustainable long term solution. In recent years, several alternatives have already been proposed and implemented. Some examples include the emergence of alternative fuel vehicle, government air emission standards for vehicles, and also increasing the use of public transportation. Alternative fuel vehicles such as electric powered cars are starting to be mass produced, while several cities such as California has implemented strict emission standards for vehicles. Neighbouring Singapore has been showing such efforts by implementing strict rules and regulations on car ownership and enforcing congestion charging for private vehicle entering busy areas during peak hours.

Therefore, in order to improve the condition in Kota Kinabalu and to provide a sustainable solution, a shift from private transport bias to public transport must be achieved. To achieve this, the city must undergo a total overhaul on its public transport system, as well as policies related to private vehicle usage. One of the supplement to help boost public transport usage is by restricting the usage of private vehicle within the central business district. This has been achieved by Singapore by implementing a congestion charging system.

Researches related to congestion charging in Malaysia is sparse. Only one research that related to urban road congestion charging was found during the time of this study. However, the paper itself does not focuses on congestion charging. Instead, the paper discusses on travel demand management, and it listed congestion charging as one of the solution for a sustainable transportation system in Malaysia, specifically, in Kuala Lumpur.

As such, any studies that are related to urban road congestion charging in Malaysia is justifiable. Since the only study related to congestion charging in Malaysia focuses on the implementation in Kuala Lumpur, any research associated with congestion charging in other cities in Malaysia is reasonable. In the case of this study, there has been no documented research of congestion charging in Kota Kinabalu, making this a novelty research.

1.3 Scope of Work

The scope of this study is on the perception of people in Universiti Malaysia Sabah (UMS) towards the implementation of congestion pricing in Kota Kinabalu. All the data collected are from people that reside, work or study in the university. Foreigners and expats that reside and work in UMS are also included. However, tourists and locals visiting from other regions are not included.

The proposed area to implement congestion charging for this research is located within the central business district of Kota Kinabalu, as highlighted in Figure 1.2. Based on Figure 1.2, it can be seen that there are a total of six (6) road entering the main study area. During peak hours, these access points will be congested as commuters from all sides are entering or exiting the city centre. In some cases, such as school holidays or public holiday season, these access routes are also congested albeit at a different time of the day.

This study only focuses on several types of land transport, which are cars, vans, commercial vehicles, and motorcycles. Any forms of public transport such as buses and taxi are excluded. Other forms of vehicles that are excluded are emergency service vehicles such as ambulance, and alternative transportation such as bicycles.