



**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

**DESIGN AND DEVELOPMENT OF A KINETIC  
ENERGY HARVESTING SYSTEM FOR SPEED BUMP**

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Mechanical Engineering Technology (Automotive) with Honours.

by

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**BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA**

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## APPROVAL

This report is submitted to the Faculty of Mechanical and Manufacturing Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Mechanical Engineering Technology (Automotive) with Honours. The member of the supervisory is as follow:

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                                  WAN MOHD ZAILANI

## ABSTRAK

*Bonggol berfungsi untuk mengurangkan kelajuan kenderaan apabila berada di jalan raya untuk tujuan keselamatan. Selama ini bonggol di jalanraya hanya berfungsi sebagai keselamatan jalanraya sahaja, tetapi dengan idea dan penambah baik fungsi bonggol itu sendiri, ia juga boleh digunakan menjana tenaga elektrik. Tenaga elektrik yang dihasilkan adalah apabila bonggol itu dilalui oleh kenderaan dan menghasilkan sumber tenaga kinetic kepada tegaga elektrik. Tenaga elektrik dijana oleh elemen mekanikal dan penjana. Melalui bonggol, penghasilan tenaga kinetik dihantar ke penjana dengan melalui sistem mekanikal yang dimana mempunyai getah. Tenaga elektik dijana dengan sejenis alat bernama piezoelektrik. Tenaga elektrik disimpan dihantar ke kapasitor sebagai simpanan dari piezoelektrik. Kajian utama projek ini adalah untuk merekabentuk dan membangunkan prototaip bonggol dan juga untuk menganalisa data keluaran arus voltan dari bonggol sebagai tujuan projek ini. Dengan membina prototaip ia boleh membantu mengubah tenaga buagan kinetic yang kepada tenaga elektrik yang berguna.*

## **ABSTRACT**

Speed bumper is used for all road users for safety nowadays. It serves as a way to help users reduce the speed of vehicle on the road. During this time the speed bump on the road only function as road safety, but with the idea and the enhancement of the speed bump function it can help to generate electricity. The electric is produced when the speed bump passed by the vehicle and produces electricity. The electricity is generated by converting kinetic energy to electrical energy. Through the speed bump that produce kinetic energy, than it transmitted to the generator by means of mechanical system which has rubber. The electric generate by a device called piezoelectric. The electric energy directs to capacitor as storage from the piezoelectric. The main study of this project is to design and develop prototype speed bump harvesting and also to analysis data the output voltage from harvesting speed bump as the objective of this project. By building a prototype it can help to convert waste kinetic energy to useful electric energy.

## **DEDICATION**

This humble work is dedicated to the  
My beloved father Megat Dazuti bin Megat Muda,  
My beloved mother Junaidah binti Daud,  
who have served as my inspirations.



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## CHAPTER 1

### INTRODUCTION

#### 1.1 Speed Bump

Speed bump is one of the traffic calming devices most frequently used in Malaysia. Installing such a traffic calming device has created a more liveable environment as a result of lower speeds and reduced traffic volume, improving environmental quality and road safety.

Speed bumps intend control and reduce the speed of the vehicle. The speed of the vehicle related to the speed bumps dimension length and width that force the driver to slow. The research searching of the method and solution to avoid the accidents is mainly control of the speed of the vehicle. The speed bump is important role that always and commonly used as traffic calming. Speed bumps are obstacles to lower the speed of incoming vehicles across different roads (Lav, Bilgin et al. 2018).

Commonly material that use for the speed bump is plastics or rubber, asphalt and metal. The speed bump can built in different sized, adapt in pairs with either one or two meter separated and installed on both sides with low height the speed bump at the road that want use it to reduce the speed vehicles. This speed bump have been used worldwide and can be considered safeties as to reduce the speed vehicle with effectively to the consumer of the road and it give alert determined to low speed. In area like school, resident, hospital and parking area are in commonly speeding at 40 km / h or 8 to 16 km / h. It not only as a safety and reduce speed, now the speed bump can be produce certain amount of electric

current from the design concept of the generator that provide electric to surrounding where it been installed (Schlabach K, 1997). The importantly, the advantages of speed bump is save the environment, device can be self-sustained and also implemented cheaply.

There are many forms of energy surrounding on our environment. One of idea is energy from the speed bump is left untapped and it is one of among forms of renewable energy have been wasted. The speed bump that hit by vehicle is kinetic energy that can be converted into electric energy by using specially designed speed bump while allowing down the vehicle will otherwise be transformed in the heat energy. The force exerted by the vehicle toward the ground is tapped into useful electrical energy with generator and proper mechanism as prime movers.

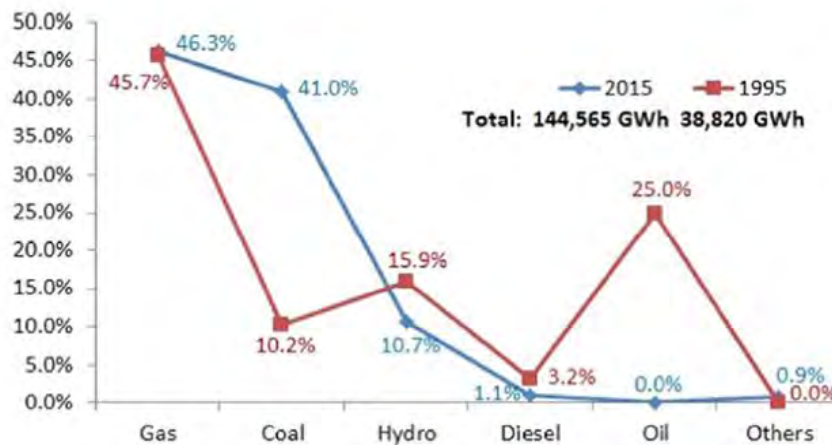
## **1.2 Source Energy**

The natural source cannot continuously and can finish. But the renewable energy can be renewed and it infinite using natural source surrounding. The energy generated using the surrounding such as solar, hydro, wind and movement because of natural source. It can save environment because it is friendly energy that cause minimal or minimal zero effect to green house, contrast to the fossil fuel where it exist eternally and plentiful quantity in the environment. The energy that can renewable is ready inexhaustible, to be connected and the most importantly it is clean alternative to the fossil fuel (Department, E.a.M.S, 1995).

As we know in every human being`s life today, the electricity is the very important role in daily life. We can`t visualize a world without electric. In the way to produce more power energy from every corner, from larger scale to Nano-scale electricity can immersed in the ways of every human being in this planet deserve its share. A country`s that

economic growth stands for its energy consumptions, especially when country that rapid growth quickly. The reliable and affordable energy accessibility is extremely important to ensured continued development. Electrical energy besides water has become more of the fundamental right and it is no longer regarded as an essential necessity for society in any growing country economy.

Malaysia is the main source of electricity for the longest time, with fossil fuels such as natural gas, coal hydro, diesel, oil and others. Decades of overuse of this natural resource have caused not only contamination, but also global warming a climate change. In the 2001, the Malaysia`s government began to push for renewables source as alternative in the light of the fact that its rapidly diminishing resource do not replenish sufficiently quickly to cope with such unrelenting consumption (Oh, 2018).

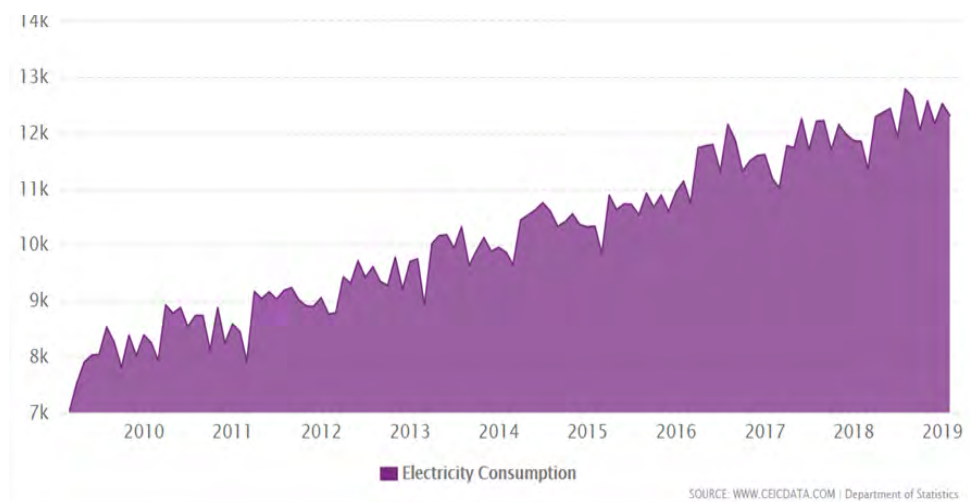


**Figure 1-1: Natural source electrical generation in 1995 and 2015 (Malaysia Energy commission, National Energy Balance, 2014)**

Gas and coal sources are the commonly source of electricity generating in Malaysia. The gas and coal maintain top of use in Figure 1.1. Source like this are generally use in thermal types. In Malaysia, there is several type plants linked to Tenaga Nasional Berhad where local companies supply electricity. Since this type of source only appropriate source

in Malaysia that still ben used until today because even the overall cost for the system is high. The high cost of high technology equipment mean that electricity and high fossil fuel prices are generated using this method.

The entire natural source generated in Malaysia is the main source of income. The lot of source in our country sell the more profit to the nation economy. It must therefore reduce the use of these resources in our country as much as possible through the replacement of less cheaper sources. Our country`s main electricity value approximately at 12000kV. This value of electricity sends to the main substation before it can be supplied to the consumer. Sometimes the electricity is needed due phenomena. This call overloads phenomena due to growth of high electricity energy equipment used today. Figure 1.2 shows Malaysia's increase in power consumption from 2010 until 2018. The graph shows that power numbers need to increase as time increases due to our country's development (Malaysia - electric power consumption, 2009).



**Figure 1-2: Graph of Power Consumption in Malaysia from 2010 until 2019**  
**(Malaysia - electric power consumption)**

The use of gas and coal sources is nowadays not on going because it is not renewable. Some studies show the forecast that one day this source will end on this sources continuity. Because of the problem identified, it is necessary to produce something that can produce electricity through use of renewable energy daily and for the future.

### **1.3 Problem Statement**

The purpose of this project is to develop an energy harvesting device in Speed Bump to use waste kinetic energy. For many years, the speed of energy consumption has been faster than natural resource regeneration because of the natural resource shortage problem. On renewable energy harvesting technologies and exploring to increase the energy harvesting efficiency of the energy harvester system in this project. In the forms of riding cars, motorcycle busses and other vehicles, almost all people in Malaysia use road very often. Electric power supply and storage for road lamp and traffic light, which is critical to the safety and mobility of transportation.

### **1.4 Objective**

- i. Design and develop prototype speed bump harvesting.
- ii. To analysis the electrical data from the kinetic energy harvesting speed bump.

## **1.5 Scope**

There is a scope to follow in order to complete this project:

- i. Design and built a prototype for kinetic energy harvesting speed bump.
- ii. Measure and analyse the output data from the kinetic energy harvesting speed bump.

## **1.6 Research Organization**

This project took steps to accomplish. The steps taken to achieve the study goal and goals would be clearly illustrated in this report. Research and project reports on speed bump harvester topics would be discussed in detail in the next chapter. Including the design, the piezoelectric and few common types of traffic energy harvesters have been studied. Also included in the chapter was some research on the possible impacts.

The procedures for conducting study in the project were narrated and demonstrated in chapter three. Choices of design by using design procedure were explained for each and setup data output voltage from energy harvesting.

Chapter four covered the final design and simulation results for all the impacts studied. This chapter included calculation process, results table, graphs, and discussion of results. This report's final chapter would be to conclude the studies conducted in this project. Lastly chapter is about the conclusion where could be deduced from the results obtained. Some suggestions were given to improve the study in order to ensure further investigation could be carried out on the topic.

## CHAPTER 2

### LITERATURE REVIEW

#### 2.1 Introduction

Road in the Malaysia has built before independence. Before 1957, the road system from Johor states from south until Perlis at the south Malaysia and also until to east Malaysia where have Terengganu and Kelantan linked each other together. Year after year past the independence, the entire roads in all over Malaysia were upgrading the system of the road every five year by the Federal Government Malaysia (Malaysia roads JKR).

All the behaviour in all road users such as driver all normal vehicle, heavy vehicle and sidewalks in the Malaysia can be changed cause of interact of traffic calming method (HPU, 2002). As the safety precaution and very important aspect, (Appleyard, D, 1981) recommended that of the government that have provide traffics lights, street sign, speed bump and awareness program can affected all road user to always aware because the day by day the volume of user in road increase and more risk to accident. In Malaysia, there are 3 type of network road system that use by consumer in main road network system. The road connecting with state and municipality roads is 61,420 km. The federal road over Malaysia is 18,904 km and the highways road is 1,820 km. The road over three type of the network is 82,144 km.



**Figure 2-1: Road map in Peninsular Malaysia (MALAYSIAN ROADS JKR)**



**Figure 2-2: Road map in east Malaysia**