



**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

**DESIGN AND DEVELOPMENT OF SPORTBIKE (MOPED  
YAMAHA Y15ZR) FRAME SLIDER (ALUMINIUM)**

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Mechanical Engineering Technology (Refrigeration and Air-Conditioning Systems) 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 Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Mechanical Engineering Technology (Refrigeration and Air-Conditioning Systems) with Honours. The member of the supervisory is as follow:

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(Mohd Faez Bin Zainol)

## ABSTRAK

Di Malaysia, salah satu pengangkutan utama adalah motosikal kapcai dan satu daripada contoh motosikal kapcai adalah Yamaha Y15zr. Ada aksesori yang boleh diletak ke motosikal ini untuk melindungi dan mengurangkan kerosakan pada kulit enjin dan penghadang tepi motosikal iaitu peleret bingkai. Bilangan pengguna Yamaha Y15zr kian meningkat namun bilangan peleret bingkai masih kurang di pasaran. Matlamat projek ini adalah untuk membuat tiga reka bentuk pad pakai habis dan mengarang setiap reka bentuk pad pakai habis yang telah direka, menguji prestasi setiap pad pakai habis dan mengarang bingkai sebagai penyokong untuk pad pakai habis untuk peleret bingkai. Dalam pelajaran ini, 3 reka bentuk pad pakai habis dikarang dan diuji. Ia diuji menggunakan Model DX Hidraulik Sistem Pengujian dan data yang diperolehi dari sistem tersebut adalah graf beban lawan perubahan jarak. Daripada data yang diperolehi, kekuatan alah, Young's modulus dan kekuatan muktamad setiap reka bentuk dikira. Ciri yang paling penting adalah kekuatan muktamad untuk setiap reka bentuk. Kekuatan muktamad reka bentuk 1, reka bentuk 2 dan reka bentuk 3 adalah 535.906 MPa, 707.414 MPa dan 306.035 MPa berturut-turut. Kekuatan muktamad, kekuatan alah dan daya impak akan dibanding untuk memastikan pad pakai habis dapat diaplikasikan pada motosikal. Setiap reka bentuk mempunyai kekuatan muktamad yang berbeza kerana setiap pad pakai habis mempunyai kawasan permukaan sentuh dan reka bentuk yang berbeza. Dalam keadaan sebenar, reka bentuk 3 yang terbaik antara 3 reka bentuk disebabkan nilai estetik dan data hasil yang masih boleh diterima. Pengajian selanjutnya adalah disarankan untuk menambahbaik kekuatan pad pakai habis dan untuk memastikan bingkai tambahan tersebut berfungsi semasa kemalangan.

## **ABSTRACT**

In Malaysia, moped motorcycle is one of the main vehicle used and one of the example of moped motorcycle is Yamaha Y15zr. There is an accessories that can be added to this motorcycle to protect or reduce the damage on the engine cover or the fairings of the motorcycle which is frame slider. The number of users of Yamaha Y15zr is keep on increasing however the amount of frame slider for the motorcycle is still inadequate in market. The aim of this study are to create three different designs of the wear pad, to fabricate the proposed design of the wear pad, to test the performance of the wear pad and to fabricate the frame as the supporter of the wear pad of the frame slider. In this study, 3 designs of the wear pad are created fabricated and tested. It is tested by using Model DX Hydraulic Testing System and the data obtained from the system is in load against extension graph. From the data obtained, the yield strength, Young's Modulus and ultimate strength of each designs are calculated. An important characteristic to be focused on is the ultimate strength of each design. The ultimate strength of design 1, design 2 and design 3 are 535.906 MPa, 707.414 MPa and 306.035 MPa consecutively. Those ultimate strength, yield strength and impact force are compared to make sure the wear pad is applicable to the motorcycle. Each designs of the wear pad has different ultimate strength since each of the wear pad have different contact surface area and design. In real application, design 3 is the best among 3 design because of aesthetic value and the result data is acceptable. Future research are recommended in order to improve the strength of the wear pad and to make sure the additional frame is functioning during accident.

## **DEDICATION**

I dedicate my dissertation to my family and many friends. A special feeling of gratitude to my loving parents, Yakup and Saniah whose give me endless support throughout my studies and push for tencity ring in my ears. My sisters Norhayaty, Norsyarina, Norazmah and Norhidayu who's never left me alone and are very special.

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# CHAPTER 1

## INTRODUCTION

### 1.1 Background

One of the main vehicles in the urban areas of some Asian countries such as Taiwan, Malaysia, Indonesia and Vietnam is the motorcycle (Le & Nurhidayati, 2016). The motorcycles are divided into three basic types which are street, dual-purpose and off-highway. One of the moped bike that are usually used in Malaysia is Yamaha Y15zr which is an under standard types of motorcycle. There are many variety types of bikes where the component is almost the same and accessories are added to the motorcycle to rise its appearance and safety. Some of the accessories added to the motorcycle are to reduce the percentage of impact or to reduce damage to the motorcycle when accidents happened. Among the concept that have been considered that could potentially reduce the damage to the motorcycle during an accident is a frame slider. A frame slider is a device that could protect the engine cover and the fairing of the motorcycle (Cited, City, & Data, 2003). It is either attached to the frame of the motorcycle itself or need an additional frame to attach it to the wear pad. A wear pad is a part of the frame slider which will have the greater impact with the road during an accident. Usually, this wear pad is replaceable because the wear pad will be damaged once an accident occurs.



## **1.2 Problem Statement**

Nowadays in Malaysia, with the increasing number of users of Yamaha Y15zr on the road, the accessories of the moped bike are still inadequate especially the frame slider. Most of the frame slider are imported from our neighbouring country such as Indonesia, Vietnam and Thailand. The price however is expensive due to the import tax and Goods and Service Tax (GST) charge on any imported goods (Custom Department, 2013). On top of that, there are not many choices of design that can be choose which can be considered as a lack in the motorcycle industry in Malaysia. Besides, the lack designs of frame slider in Malaysia causes the invention of the frame slider for Yamaha Y15zr could potentially gain interest from manufactures and bikers.

## **1.3 Objectives**

There are four objectives to achieve from this project, the first one is to design three different designs of the wear pad. Next is to fabricate the proposed design of the wear pad. The third one is to test and analyze the performance of the wear pad. Lastly, to fabricate the frame to attach wear pad and become crash bar.

## **1.4 Scope**

The frame slider is designed especially for Yamaha Y15zr. The material that be used to fabricate the wear pad is aluminium 2xxx series whereas for the frame which will hold the wear pad is the mild steel. The purpose of fabricating the frame is just to hold the wear pad since there is no suitable place to locate the wear pad if there is no additional frame added to the motorcycle. The outer diameter of the wear pad is limited to 4.5 cm. The performance test of the wear pad is only subjected to compression stress test by using the Instron Model DX Static Hydraulic Universal Testing System equipment in Solid Mechanics Lab which the maximum force applied will be set around 500kN and the maximum deformation will be set to 10 mm. There is no actual

testing done in this project. The invention of this wear pad is to prevent any damage on the side fairings of the Yamaha Y15zr if the motorcycle falls over during parking or fall during doing a U-turn. This product will may be not functional in any sliding incident occurs.

## **1.5 Thesis organisation**

This report comprised of three chapters. Chapter 1 is the introduction of the project including the background, problem statements, objectives and research limitation as well as the work scope of the study. Chapter 2 is written to review the theories, experimental works, journals, and findings that was done in the past research with respect to the current project. In chapter 3, the methodology used to achieve the objectives that was set for this study will be explained clearly. Besides, all materials and apparatus, procedures and experimental work used for this study will be described.

## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.1 Introduction**

This chapter will review the topic what was published by accredited scholars and researches which is related to the study that will be made. Motorcycle has been one of the most preferable vehicle used in Malaysia. It is used either as a daily transport or it is more than just a mode of transport to some people. It is unbelievable for individuals to spend thousands of dollars on paint jobs for these specialty motorcycle as restoration of older models and stylized modifications of new models have become a hobby for many (New & Fl, 2005).

#### **2.2 Motorcycle design element**

In designing a motorcycle, there are several elements that a designer should consider in ensuring the safety of the motorcycle. There are two categories of motorcycle design element which are the crash prevention element and crash protection element.

### **2.2.1 Crash prevention characteristics**

The crash prevention elements on motorcycle is the features on the motorcycle which will prevent the motorcycle from crash. This will increase the safety of the rider and the motorcycle from crash that might cause injuries and damages. There are many parts on the motorcycle that is related to prevent the motorcycle from accident. It includes the braking system and visibility aids such as rear-view mirrors and design issues, for example the size and location of mirrors, rider position, helmet design and physical agility (R.J. Naim and Partners Pty Ltd, 1992).

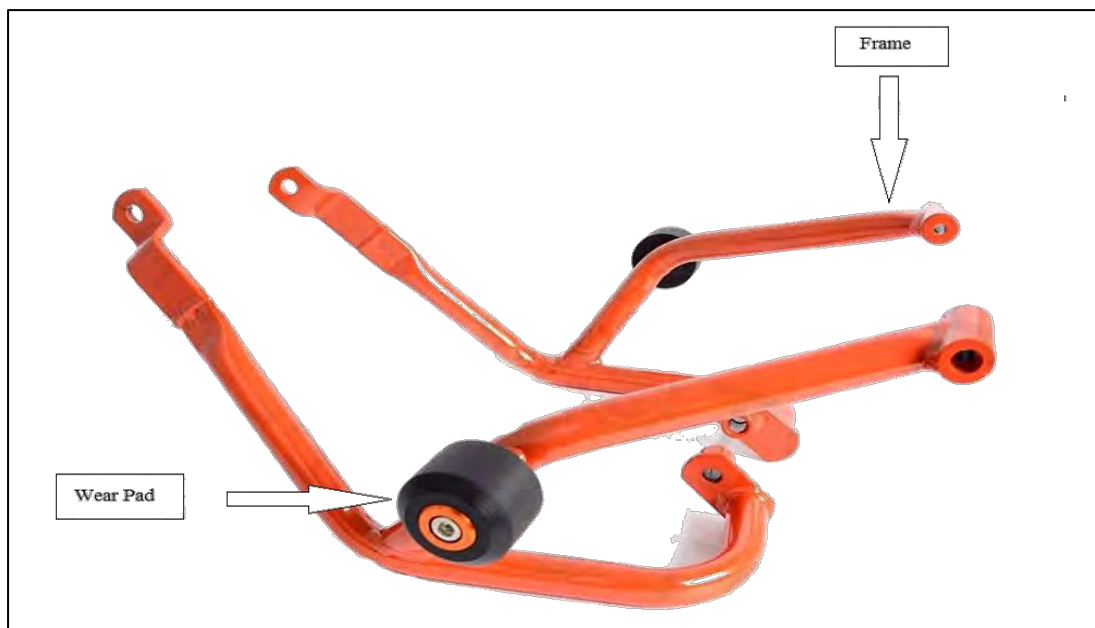
### **2.2.2 Crash protection elements**

The crash protection elements are the features that could protect the rider and the motorcycle to have some serious damages during an accident. It is an added device to the rider or the motorcycle to protect them during accident. Some types of the protective device seems effective in certain types of accident (R.J. Naim and Partners Pty Ltd, 1992). The examples of protective device available are the air bags, crashbar protection, motorcycle crashworthiness, helmet and frame slider. The effectiveness of those device is limited to a restricted range of crash and situations (R.J. Naim and Partners Pty Ltd, 1992).

## **2.3 Frame slider**

Frame sliders is a device that can be mechanically fastened to the motorcycle to protect certain areas from damage especially during sliding incident (Buell et al., 2004). According to Buell et al., the frame sliders includes a bolt that is mechanically fastened to the motorcycle frame and replaceable, cylindrical shaped puck that is positioned over a portion of the bolt where the puck can be made from many materials

such as plastics and metals. The function of frame slider has been known in the art as a turn or directional signal substitute (Elliot, 2003). Elliot (2003) also stated that the instant invention is directed to an improvement of the conventional motorcycle frame slider to provide improved safety to both frame and faring which eventually provide an enhanced visibility and aesthetics value of the motorcycle. Therefore, the frame slider is very important especially to prevent damage to the motorcycle frame during sliding incident. Based on a statement from Wood (2005), the most common frame slider assembly which were sold by numbers of manufactures, attaches a wear pad directly to the frame of the motorcycle by using a primary bolt that runs through the center of the wear pad. This wear pad will take the abrasion from the racetrack and damage eventually can be prevented. The example of a frame slider is shown as in Figure 2-1.



**Figure 2-1:** Frame slider available in market

**(Source: <http://www.ebay.com>)**

## **2.4 Protective motorcycle parts**

According to Elliot (2003), the instant invention is directed to an improvement of the conventional motorcycle frame slider to provide improved safety to both frame and fairing which eventually provide an enhanced visibility and aesthetic value of the motorcycle. Frame and fairing are the main parts of the motorcycle. Generally, the parts of motorcycle other than handlebars that extends the furthest laterally from the centreline of the motorcycle, such as the frame and fuel tank, will be subjected to the most significant forces during accidents (P. Winner, 2006).

### **2.4.1 Main frame**

The function of the main frame is to mount other part of the motorcycle such as the gearbox, engines, footrest etc. The frame serves as a skeleton of which components like the gearbox and engine are mounted and consists mostly of hollow tubes (Bhunte & Deshmukh, 2015). According to Bhunte & Deshmukh (2015), the frame also aids as a support for the suspension system, to keep the wheels in contact with the road and cushions the rider from bumps and jolts with the help by the collection of springs and shock absorbers. Motorcycle frames are a rigid units which the steel tubing or stampings welded to it and for special-purpose riding, some bikes have aluminium or other light alloy frames (Lear & Mosher, 1977). Figure 2-2 illustrate example of motorcycle main frame; the figure shows the main frame of Yamaha Y15zr that is available in the market.



**Figure 2-2:** Yamaha Y15ZR main frame

(Source: <http://www.chongmotorclub.com.my>)

#### **2.4.2 Body cover/ Fairings**

The body cover or fairings are the cover of engines, tanks, chassis and some other component of the motorcycle. The functions are also to make the motorcycle have an attractive and aesthetic appearances. According to H. Nebu and R. Cited (1992), different types of motorcycles vary with the sections of the motorcycle to which cover are applied along with the type of cover used. The motorcycles fairing functions are to provide an advanced air ducting system that promotes a smooth laminar air flow along the length of the motorcycle and to enclosing the engines and other parts of the motorcycle. (Hill, 1990). The example of motorcycle body cover/fairings are as shown as in Figure 2-3, it is the body cover of Yamaha Y15ZR.



**Figure 2-3:** Yamaha Y15zr body cover/fairings

(Source: <http://www.yamaha-motor.com.my>)

## 2.5 Joining method

Joining method is the method of combining two or more parts or subassemblies. Most common situation is when a commercial product is an assembly, a composition of single parts or single parts called subassemblies, which are groups of single parts combined to serve certain purpose and forming part of a larger assemblies (Marinov, 2012). Joining method is important so that each of parts can be combined effectively. Designers need to consider how they will effectively join two or more components into a functional item and a cost-effective, aesthetically pleasing and structural sound solution for designing and manufacturing complex parts can be achieved through joining technique (Marshall, 1976). The joining method can be divided into two major classes which are permanent combining process and temporary combining process. Permanent combining process is a process of combining two or more parts into one larger part that cannot be disassembled after the combining process. Marinov (2012) stated that the components in the assembly would result in severe damages if there is eventual disassembly and it is not possible do any subsequent assembly anymore. Temporary combining process is a process that allow multiple assembly and