

DESIGN AND ANALYSIS A RELIABLE AND COMFORTABLE SEAT FOR
BICYCLE

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DECLARATION

“I hereby declare that the work in this thesis is my own except for summaries and quotations which have been duly acknowledged.”

Signature:

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To my lovely parents, Mr. Sulaiman Bin Abd Rahman and Tuan Rabiah Binti Tuan
Sayed for everlasting support and do not forget also to supervisor, lecturers and
friends.

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ABSTRACT

Bicycle seat or also known as bicycle saddle is one of the important parts in the design of a bicycle. Failure to design bicycle seat can cause extreme pain to the riders. The objectives of this investigation were to design a reliable and comfortable seat for bicycle due to the pain suffered by sport bicycle users and perform the stress analysis or Finite Element Analysis (FEA) on the developing concept design and the existing seat by using Computer Aided Design (CAD) software to compare both results. This analysis was conducted to determine the strength level of the bicycle seat. The researches were carried out by referring to the engineering and medical journals, books, and websites. At the end of this research, a design concept has been developed and the comparison of both products which exist and new seat concept design with the value of von mises stress and translational displacement showed the capability of the new concept are strong enough and acceptable.

ABSTRAK

Tempat duduk basikal atau juga dikenali sebagai pelana basikal adalah salah satu bahagian yang penting dalam reka bentuk basikal. Kegagalan untuk mereka bentuk tempat duduk basikal boleh menyebabkan kesakitan yang amat sangat kepada pelumba. Objektif penyiasatan ini adalah untuk mereka bentuk kerusi dipercayai dan selesa untuk basikal kerana kesakitan yang dialami oleh pengguna sukan berbasikal dan melaksanakan Analisis Unsur Terhingga (FEA) terhadap konsep rekabentuk tempat duduk baru dan tempat duduk yang sedia ada dengan menggunakan perisian Lukisan Berbantu Komputer (CAD) untuk membandingkan kedua-dua keputusan. Analisis ini dijalankan untuk menentukan tahap kekuatan kerusi basikal. Kajian yang telah dijalankan dengan merujuk kepada kejuruteraan dan perubatan jurnal, buku, dan laman web. Pada akhir kajian ini, satu konsep reka bentuk telah dibangunkan dan perbandingan kedua-dua produk yang sedia ada dan rekabentuk konsep baru telah dibuat berdasarkan nilai tegasan von mises dan anjakan translasi dan ia menunjukkan keupayaan konsep baru adalah cukup kuat dan boleh diterima berbanding rekabentuk sedia ada.

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LIST OF SYMBOLS

ε = Strain

σ = Stress

τ = Torque

σ' = Von Mises Stress

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ABBREVIATIONS

ED	-	Erectile Dysfunction
LBP	-	Lower Back Pain
PSM	-	Projek Sarjana Muda
HOQ	-	House of Quality
CAD	-	Computer Aided Engineering
WDM	-	Weighted Decision Matrix
QFD	-	Quality Function Deployment
PDS	-	Product Design Specification
FEA	-	Finite Element Analysis
FEM	-	Finite Element Model
CATIA	-	Computer Aided Three-dimensional Interactive Application
HOT	-	Hierarchical Objective Tree
AHP	-	Analytical Hierarchy Process

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

The purpose of this report is to develop a conceptual design for bicycle seat that ergonomically suits human body posture. It is planned to create a new product that can make comfortable to the riders and reduce the pain that endured while cycling especially in cycling sport. This idea was propose by me because of sicknesses, disease and complaints that issued by the cyclists around the area of pubis and ischium bone (seat bone) while they were doing cycling exercises that making them uncomfortable. Based on researches, the pain occurred most probably due to the designation of the seat that are not suitable and user friendly or in short, are not ergonomic. According to Meriam Webster (2010), ergonomic can be define as; science that deals with designing and arranging things so that people can use them easily and safely.

1.2 BACKGROUND

Bicycle seat is part of bicycle which the rider sits while cycling. Normally, this part is made from hard plastic as the shell of the seat, and it will be covered with the layer of foam for rider's comfort. Having a right seat when doing rigorous exercise like cycling somewhat similar concept of choosing a pair shoes. If we get the wrong shoes size, we will endure great pain while wearing it.

The function of bicycle seat is closely related to the movement efficiency of the bike and the comfort for the rider. The seat design was simple when it first appeared around the year of 1818. It is harder than a wooden plank. The high wheel bicycle with a small wheel at the back or also called as the Penny Farthing Bicycle have uncomfortable seat. When riders put all the body weight on the seat, they need to use more energy to paddle because the bicycle is hardly moving forward (Rankin & Neptune, 2010). From the first edition of the seat design until nowadays, the improvement and evolution of the bicycle seat occur greatly however, the ergonomic and best bicycle seat was not yet accomplished. The designs only focus on the function of the seat and to make sure it looking good for market purpose.

1.3 PROBLEM STATEMENT

The relation between the saddle and the rider are very important. In definition, the saddle is the place to support the body weight when the rider is in sitting position. If the saddle causing pain and uncomfortable feeling to the rider, it can totally ruins the riding experience. It was reported that 30% of women have had genital surgery while giving birth to their children and it will make them prone to get injury at pubic and ischium area. Others ended their riding careers because of the saddle discomfort. High pressure on the perineum, under the pubic bone is a typical pressure distribution for males, but really rare occurs in females. It's not healthy for many men, but can be very painful for many women. According to Damon Rinard (2002), the designation of the saddle nowadays is unhealthy for both genders.

From the point of view of the ischium and the pubis bone, it is attached to various muscles and supports the weight of the body when one is sitting. According to Ross Hauser (2014) ischial tuberosity pain at red point (pain that occur at pubis and ischium bone) showed in Figure 1.1 below may occur to wide range of athletes, especially to the cyclist.

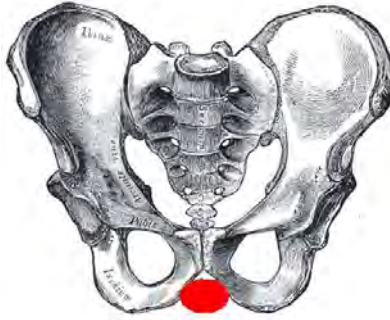


Figure 1.1: Perineum area and Pubic Bone
(Source: Damond Rinald, (2002))

1.4 OBJECTIVE

The objective of this project is to:

- i. Design a reliable, comfortable and ergonomic seat for bicycle.
- ii. Perform a stress analysis on the product by using Computer Aided Design (CAD) software.

1.5 SCOPE

Among of scopes of this study are to:

- i. Review of the existing bicycle seat
- ii. Generate a conceptual design
- iii. Development of the model using CAD
- iv. Stress analysis on the development design
- v. Conclusions

1.6 EXPECTED RESULT

From this project, the new designation of bicycle seat is expected to be proposed which are more save, comfortable and reliable. First of all, literature reviews are studied based on the issues that are making riders uncomfortable while

cycling which is the sickness on the skeleton around seat bone. From literature review, we could understand precisely where the problems occurred, and come out with a wise solution to make improvement on the new seat. Once all of the information had been studied, the concept design of the new reliable and comfortable seat could be extracted. The selection of the concept design will be developed by using CAD software. Meanwhile, the stress analysis of the new concept design is performed to ensure functionality of the seat.

CHAPTER 2

LITERRATURE RIVIEW

2.1 INTRODUCTION

Nowadays, there are mountains of seat designs for bicycles seats in the market. All of them have their own advantages and weaknesses. As the technology and world are intensely developed, we could see the important of preventive measurement in health of human being. As the matter of discussion, new design of the saddle should be proposed that fulfill the ergonomic demand of human population today that enable the user to enjoy exercise and maintain good posture of the body.

Everything comes with purpose, this includes bicycle seat which aim to support body weight of the rider. It is one of the three parts of human body that are intact to the bicycle when in riding position, other two are handle bars and pedals. While cycling, bicycle seat takes the majority of body weight, while positions of the body over the pedals and helps to control and balancing the bicycle.

The seat somewhat will be used interchangeably with saddles, while both of them have their own definition respectively. It is first named as seats, which is designed to support the entire body weight. On the other hand, a saddle is also something that is used to support the body, but not majority of the body weight.