

THE DEVELOPMENT OF COMPOSITE BODYWORK OF NOSE CONE PANEL  
FOR FORMULA VARSITY RACE CAR

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‘Saya akui bahawa telah membaca karya ini dan pada pandangan saya karya ini adalah memadai dari segi skop dan kualiti untuk tujuan penganugerahan Ijazah Sarjana Muda Kejuruteraan Mekanikal (Automotif)’

Tandatangan : .....  
Nama Penyelia I : .....  
Tarikh : .....

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Laporan ini dikemukakan sebagai memenuhi sebahagian daripada syarat  
penganugerahan Ijazah Sarjana Muda Kejuruteraan Mekanikal (Automotif)

Fakulti Kejuruteraan Mekanikal  
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“Saya akui laporan ini adalah hasil kerja saya sendiri kecuali ringkasan dan petikan yang tiap-tiap satunya saya telah jelaskan sumbernya”

Tandatangan : .....

Nama penulis : .....

Tarikh : .....

*To my parents..*

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2<sup>nd</sup> April 2008

## ABSTRACT

This project is about the development of bodywork of the new nose panel of Formula Varsity race car by using composite material which is fiberglass/polyester laminated. The developments that has been planned in the bodywork are the refreshing new design for the nose cone panel which more focus on the element of aerodynamic and plus the weight reduction of the panel since the composite material replace the sheet metal. Furthermore, there is some analysis which known as Flexural Test that has been done in order to find the right type of layer for fiberglass. The test result show the flexural strength of each type of layer and based on the comparison between each specimen, only one specimen that have good flexural strength will be chosen in the fabrication process. The fabrication process used in this project is hand lay-up which has the lowest manufacturing cost but can produce the high quality of product.

## ABSTRAK

Projek ini adalah berkaitan dengan penambahbaikan bahagian luar kereta lumba Formula Varsity iaitu komponen hadapan kereta lumba (“nose cone”) dengan menggunakan campuran gentian kaca dan polyester. Antara penambahbaikan yang telah dirancang adalah merekabentuk komponen dengan bentuk baru yang lebih mementingkan nilai aerodinamik. Selain itu pengurangan terhadap berat komponen juga dilakukan memandangkan kepingan logam yang digunakan sebelum ini diganti dengan penggunaan bahan komposit. Di samping itu, satu analisis yang dikenali Ujian Lentur telah dilakukan dalam usaha mencari jenis lapisan gentian kaca yang sesuai. Keputusan ujian menunjukkan darjah kelenturan bagi setiap jenis lapisan dan berdasarkan kepada keputusan tersebut, satu jenis bahan ujian sahaja yang dipilih untuk digunakan dalam proses fabrikasi. Proses fabrikasi yang digunakan dalam projek ini ialah fabrikasi menggunakan tangan yang mempunyai kos pembuatan yang rendah tetapi mampu menghasilkan produk yang berkualiti tinggi.



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**LIST OF SYMBOLS**

$\sigma$	=	Flexural strength
$P_{max}$	=	maximum load at failure
$b$	=	specimen width
$h$	=	specimen thickness
$L$	=	specimen length between the two support points



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## CHAPTER I

### INTRODUCTION

#### 1.1 Background of Project

Formula Varsity Race Car is constructed by student from Faculty of Mechanical for Formula Varsity Race each year between the local universities in Malaysia. The outer panel of the car is divided into two sections. Front section is called as nose cone while the middle section is called side port as shown in the Figure 1 below.

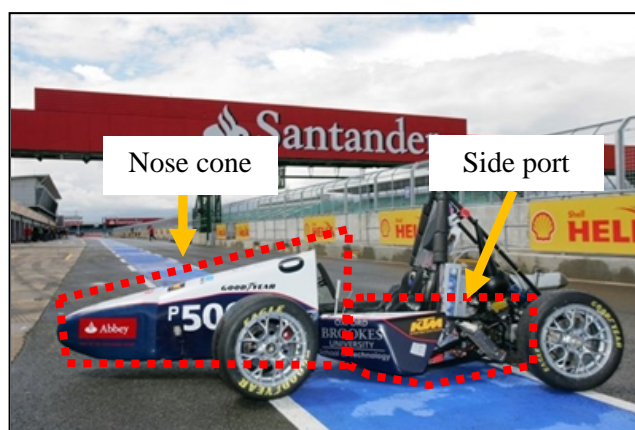


Figure 1: Section of outer panel Formula Varsity Race Car [1]

This project is actually involved with the nose cone panel only. The construction of the new nose cone panel will consider the following factors:

- i. Material quality which determine the lifetime of the panel.
- ii. Aerodynamic effect to enhance the speed performance.
- iii. Manufacturing process which limited by the cost of the manufacturing and the ability to manufacture it.

If compare to Formula Student car that been made by university from other country, it has already used composite material. The bodywork also has achieved a high standard of quality. So, the development that will be made through this project will open a new potential to experience the new type of material for bodywork of Formula Varsity race car which using composite material instead of using sheet metal.

## **1.2 Project Significant**

This project will result to the development of the nose cone panel for Formula Varsity Race Car. The new composite material used in the fabrication will replace old method of fabrication which is use sheet metal. The composite material will give a lot more advantages compare to sheet metal. In design aspect, old design will be replace by this new design which has more aerodynamic effect and also good looking. Furthermore, the composite material that will be used will provide weight reduction to the total weight of race car. Through this project, there are chance to explore in composite manufacturing. The new panel that used composite material will be used in the next construction of Formula Varsity Race Car after this.

## **1.3 Problem Statement**

Previous car project developed by the Faculty of Mechanical student had used bodywork made of sheet metal. Even though sheet metal can provide the mechanical properties needed for the application, the major draws back are it is heavy and

difficult to shape. This project is about the development of the composite bodywork for nose cone panel using glass fiber polyester laminates.

#### **1.4 Objectives**

The objective of this project is to develop nose cone panel for Formula Varsity race car by using composite material which is glass fiber polyester laminated.

#### **1.5 Scope**

There are five scopes in this project in order to achieve the project objective.

- a.** Study about the types of fiberglass and the method that already been used in fabrication of fiberglass. The study also includes the principle theory of fiberglass and the latest development in fiber glassing.
- b.** To create design of nose cone panel using computer aided drawing software. The design must include aerodynamic effect.
- c.** Find the right method for fabrication process based on normally used method or create new method as long as all the criteria are achieve.
- d.** Analysis of flexural test is needed in order to prove that which method will give an appropriate result.
- e.** To fabricate nose cone panel using the chosen composite material and the chosen method.

1.6 Planning and execution task

Table 1.1: Gantt chart for PSM I

Activity	2008																	
	July					August				September					October			
	Week 1	Week 2	Week 3	Week 4	Week 5	Week 1	Week 2	Week 3	Week 4	Week 1	Week 2	Week 3	Week 4	Week 5	Week 1	Week 2	Week 3	Week 4
Project title confirmation																		
Meeting with supervisor																		
Gathering information																		
-type of composite material																		
-basic concept of glass fiber																		
-fabrication method																		
-testing method																		
Meeting with supervisor																		
Method planning																		
-design consideration																		
-sketching conceptual design																		
-testing method determination																		
-planning fabrication process																		
Meeting with supervisor																		
Submitting draft technical report to supervisor																		
Writing final report																		
Submitting final report to supervisor																		
Submitting final report to faculty																		
Seminar																		

Table 1.2: Gantt chart for PSM II

Activity	2008					2009															
	November	December				January				February				March				April			
	Week 1-4	Week 1	Week 2	Week 3	Week 4	Week 5	Week 1	Week 2	Week 3	Week 4	Week 1	Week 2	Week 3	Week 4	Week 1	Week 2	Week 3	Week 4	Week 1	Week 2	
Revision on previous report																					
Correction on previous report																					
Detailing design																					
Meeting with supervisor																					
Correction to detail design																					
Flexural Test																					
-create sample																					
-do testing																					
-analysis data																					
Meeting with supervisor																					
Fabrication																					
-Plug making																					
-Mould making																					
-End product making																					
Meeting with supervisor																					
Submitting draft technical report to supervisor																					
Writing final report																					
Submitting final report to supervisor																					
Submitting final report to faculty																					

## **1.7 Summary of technical report**

This technical report is basically described about how to fabricate nose cone panel for Formula Varsity Race Car. This report has six chapters which is the first section is introduction. In this chapter, there are stated about the objective and scopes of the project. There are also planning activities that will be done throughout the project. Second chapter is literature review which explains about the study that has been done in order to get the information about basic theory of fiberglass and also about the latest development in fiberglass. The third chapter is methodology which explains about the steps that is needed in order to achieve the project objective. The steps are finding information, design, testing and fabrication. Fourth chapter is result which explains all the result related to project includes flexural testing result and fabrication result. The fifth chapter is discussion where stated the reason for the outcome result and also all the problem arise during project. The last chapter is conclusion which will conclude all of the project activities that has already been done and also recommendation that can be done in further study.

## **CHAPTER II**

### **LITERATURE REVIEW**

#### **2.1 COMPOSITE MATERIAL**

Smith and Hashemi [2] defined the definition of composite as below:

“A composite material is a material system composed of a suitably arranged mixture or combination of two or more micro- or macro constituent with an interface separating them that differ in form and chemical composition and are essentially insoluble in each other”.

Today, the most common man-made composites can be divided into three main groups which are Polymer Matrix Composites (PMC's), Metal Matrix Composites (MMC's) and Ceramic Matrix Composites (CMC's).

#### **2.2 FIBER REINFORCED COMPOSITE**

Fiber-reinforced composite is one of the Polymer Matrix Composite materials. It consists of high strength fibers and modulus bonded to a matrix with boundaries between