



Faculty of Manufacturing Engineering

WASTE RUBBER TYRE AS ROAD DIVIDER APPLICATION

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Master of Manufacturing Engineering (Manufacturing Systems Engineering)

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WASTE RUBBER TYRE AS ROAD DIVIDER APPLICATION

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A master project report submitted

**As a partial fulfillment of the requirements for the degree of Master of
Manufacturing Engineering (Manufacturing Systems Engineering)**


Faculty of Manufacturing Engineering

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2010

DECLARATION

I hereby, declared this master project report entitled “Waste Rubber Tyre as Road Divider Application” is the result of my own research except as cited in references.

Signature : 

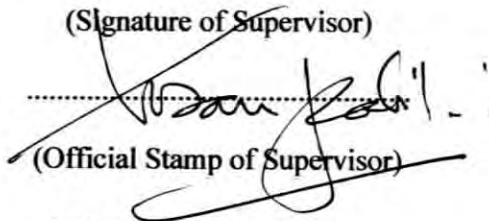
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APPROVAL

This report is submitted to the Faculty of Manufacturing Engineering of UTeM as a partial fulfilment of the requirements for the degree of Master of Manufacturing Engineering (Manufacturing Systems Engineering). The member of the supervisory committee is as follow:

(Signature of Supervisor)

A handwritten signature in black ink, appearing to read 'Dan Md. Palil', is written over a horizontal dotted line. The signature is stylized and extends above and below the line.

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ABSTRACT

Waste tyre is performed as a main material for produced a valuable product. Commonly, land filling of waste tyres for disposal purpose is relatively cheap and easy to achieve, but in reality, this is a waste are potentially to produce a valuable raw materials and leads to many other problems if rubber are not enough for customer demand. This research is purposed to utilize a waste tyre as an impact for road divider and waste tyre are crushed for melted to develop a shape of rubber sheet. The simulate rubber sheet is laminated towards the plate of Galvanized Iron and Galvanized Steel. From the test analysis on the rubber road divider, the tensile test were giving values of tensile strength, tensile strain and young's modulus of waste rubber tyre after it melted. One piece of rubber layer (3mm) able to absorb $\pm 30\%$ while absorption would be increased as $\pm 40\%$ from two piece layer (6mm) from the impact test. Rubber acted as toughening agent which prolonged the deformation capabilities of the fabricated samples test.

ABSTRAK

Kajian ini mengutamakan tayar buangan sebagai bahan asas untuk dijadikan satu produk yang bernilai dan dapat digunapakai. Melupus tayar ke dalam tanah biasanya merupakan satu kaedah yang hanya memerlukan kos yang murah dan mudah dilaksanakan. Secara realiti, tayar adalah di antara bahan buangan yang berpotensi untuk dijadikan bahan asas ke atas sesuatu produk dan secara tidak langsung ia dapat menyelesaikan masalah jika getah tidak mencukupi. Tujuan kajian ini dilakukan adalah untuk memanfaatkan serta menggunakan tayar buangan sebagai bahan asas untuk dijadikan bahan penyerap tekanan ke atas pembahagi atau penghadang jalan raya. Di dalam kajian ini, tayar buangan di kisar halus dan dipanaskan untuk membentuk kepingan getah. Kepingan getah yang telah disimulasi disaluti ke plat keluli bergalvani dan besi bergalvani. Daripada analisis ujian yang telah dijalankan pada getah, ujian tegangan telah memberi nilai pada kekuatan getah, tegangan, terikan serta nilai modulus. Sekeping lapisan getah setebal 3 mm dapat meresap sebanyak $\pm 30\%$ tenaga manakala dengan ketebalan 6mm tenaga serapan semakin bertambah sebanyak $\pm 40\%$ daripada ujian hentaman. Getah bertindak sebagai ejen penguat untuk menguji perubahan bentuk sampel.

DEDICATION

Special thanks for my supervisor, technicians and friends.

For beloved parent, family and fiancé

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LIST OF ABBREVIATIONS

NO	-	Nitrogen Oxides
UTeM	-	Universiti Teknikal Malaysia Melaka
lbs	-	Abbreviation for pounds
PCI	-	Post Cure Inflation
NSWAI	-	National Solid Waste Association of India
W	-	Beam shape
DOE	-	Design of Experiment
SEM	-	Scanning Electron Microscope
WGRT	-	Waste Ground Rubber Tyre
PP	-	Polypropylene

CHAPTER 1

INTRODUCTION

1.0 Background

Nowadays, there are lots of wastes are generated and destroyed an environment. Some wastes are categorized likes plastics, papers, steels, chemicals matter and tyres. Waste tyres have become a major environmental issue in many countries. From the information of waste tyres management, a million transportations used a tyres in the world and an approximately one tyre is discarded per person per year.

Waste tyres is estimated around 18 million that measured in equivalent passenger units are generated in all countries each year. These waste tyres are abandoned in yard or by the road, it not only occupy land resources but also breed mosquitoes and bugs, causing a lots of environmental pollution. Thus, to solve this issue, there are many ways can be committed such as eliminated that wastes by recycle to a valuable products that can be giving an advantages for human being. Waste tyre is a reproducible resource, several benefits of waste tyres has been proposed that utilized for rubber tiles and blocks for cements material, some of them is already applied in construction.

Meanwhile, road divider is a system where it designed to keep people or vehicle from straying into dangerous situation and limit off area. The design of the road divider is generally such that a vehicle hitting the barrier is steered back onto the road. This may be achieved by designing the supports so that they break off on impact, allowing the barrier to deform and push the vehicle back on track.

In most cases road divider would not be able to withstand the impact of a vehicle just by the strength of the individual posts in the area hit by the vehicle. The road divider is effectively one strong band that transfers the force of the vehicle to multiple posts beyond the impact area or into a ground anchor at the end of road divider.

This research is focused as using waste rubber tyre as an impact for road divider. It's giving new ideas how these number of wastes can be controlled. Today's an accident almost happen along the roads and highways that always impact a road divider. Although it is a safety for road users that prevent a dangerous cases but then when an accident occurs the divider is drastically damaged and may causes a bad impact happen.

Road divider is also an object that involved into this research where it used to implement the rubber sheet onto the metal because the road divider is installed to reduce the severity of run-off road accidents. This is accomplished by limiting the damage to vehicles and the barriers with even possibility of starting a fire because of sparks originating during the friction between them. This study also can be categorized as a green manufacturing technology because when any wastes are using for particular product, it will reduce and eliminate pollution and wastes.

1.2 Problem Statement

It is well known that a numerous amount of waste tyre estimated increases every year, and it is land filled or dumped all over the world. Waste tyres that are illegally dumped or improperly stored can pose a serious threat to public health and safety, as well as to the environment such as destruction of natural places and the risk. Waste tyres can serve as a nesting area for pests and a breeding ground for mosquitoes which can spread encephalitis and other illnesses. Waste tyres can also catch fire and release toxic smoke.

To eliminate these problems and help the environment, waste tyres need to be recycled. On that ways, it can be reduced amount of waste tyres and an environmental pollution. This research is recycling a waste tyre and come out a new material as a rubber sheet.

The road divider is generally works to avoid an accident, but after an accident occurs, the damaged of metal barriers need to be repaired and it could potentially become hazardous to other road users. This problem can be solved with the idea by applied the waste rubber tyre sheet that have been recycle to the road divider to reduce the damaged of road divider and eliminate the large quantities of waste tyre. This method also helps to prevent the possibility of starving a fire because of sparks during the friction between road divider and vehicle and controlled the impact. Furthermore, by applied the waste rubber tyre onto metal road divider, it also can be limiting the dangerous curves bending and humps after a collision happen.

1.3 Objectives

The objectives of this present study are:

- i. To utilize the waste rubber tyre as an impact for road divider.
- ii. Extract and separate the rubber from beads wires.
- iii. Develop the rubber particles to form into a rubber sheet and laminate it to the road divider
- iv. Test and analysis the rubber divider.

1.4 Scope of the Research

The study is purposed for implementing a new rubber sheet from waste tyre onto a metal road divider. The briefly ideas stated from a raw material, waste tyre which is crumble by crusher machine as a sample and formed a rubber sheet using a hydraulic molding press machine. The sample specimen is allocated to conduct a tensile and impact test. The plate of galvanized iron and galvanized steel are presumed as a metal road divider for the impact test.

CHAPTER 2

LITERATURE REVIEW

2.1 Background

Literature review is a process of reviewing written and published knowledge on a topic which is from a journal article. The purpose is to present a summary of what is and is not known, identify gaps or areas of controversy, and to identify the strengths and weaknesses of the currently published work. Meanwhile the theory is a comprises a collection of concepts, including abstractions of observable phenomena expressed as quantifiable properties, together with rules which is called scientific laws that express relationships between observations of such concept.

Estimated a million of wastes was destroyed an environment pollution and one of them was a waste tyres. There are many products can be produced from waste tyre cycling. This evolution can bring lots of benefit for environment without pollution and for human too. Basically, the waste tyres were using in lots of applications and products develop such as material for filtration systems, construction fill, playground and trail surfacing, as well as molded rubber products such as belts, mats and tile.

2.2 Tyre

As all known, tyre is a composite product which an inseparable assembly of materials with a very different properties that manufacture demands a great precision. tyres need to be carefully constructed from a combination of different ingredients. As many as 200 separate raw materials can be used in the construction of one tyre.

A tyre is an advanced engineering product made of a lot more than rubber. Fiber, textile, and steel cord are just some of the components that go into the tyre's inner liner, body plies, bead assembly, belts, sidewalls, and tread. Imagine that the manufacture of this complex product is, well, complex. It requires the latest technology, heavy equipment, precision instruments and the most importantly is qualified people.

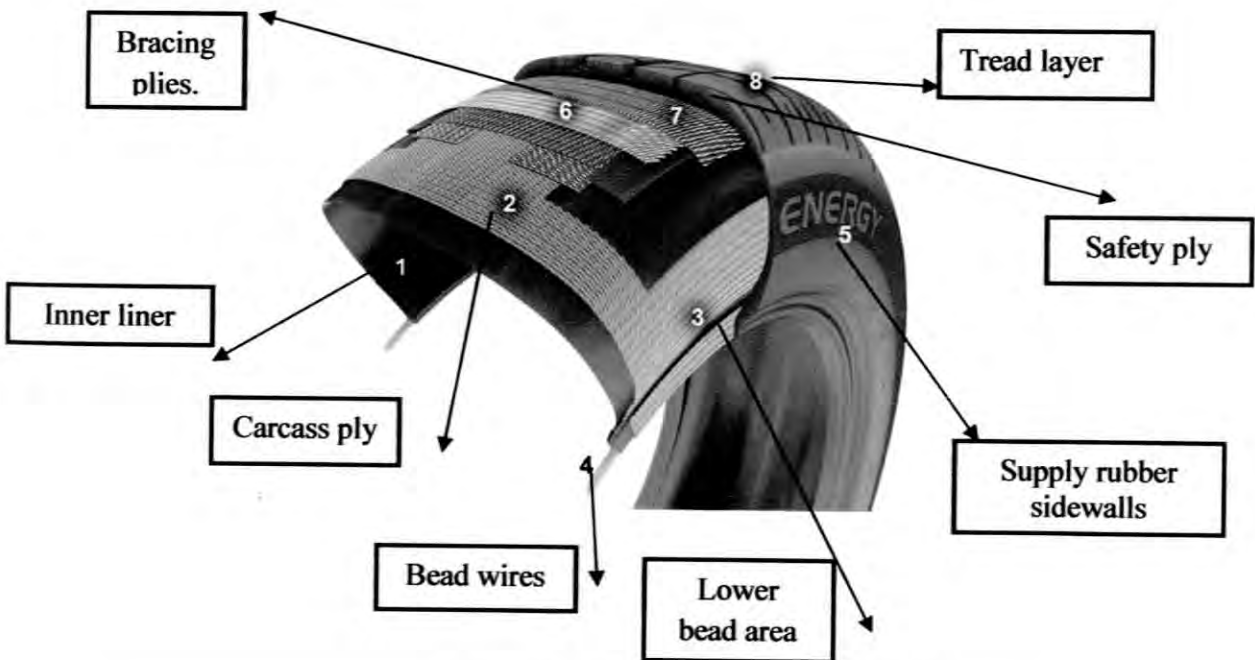


Figure 2.1 Structure components of tyre

2.2.1 Tyre Components

A lot of information of tyre component that rubber is an essential element of pneumatic tyres which is explained by Anil, et al., (1994). It offers flexibility, low hysteresis, and good friction on most surfaces, high abrasion resistance and good impermeability by contained air. The basic rubber characteristic of low resistance to tensile forces necessitates the use of an inextensible yet flexible reinforcement to avoid excessive tore deformations upon loading. The major component of typical pneumatic tyre is showed above.

- i. Carcass ply
- ii. Beads
- iii. Tread
- iv. Belts
- v. Chafers
- vi. Innertube
- vii. Inner Liner
- viii. Sidewalls
- ix. Shoulder
- x. Crown

2.3 Waste Tyre

There is a large wastage of rubber tyres in many countries and the aim of this brief is to give some ideas for what can be done with this valuable resource. Whether rubber tyres are reused,

reprocessed or hand crafted into new products, the end result is that there is less waste and less environmental degradation as a result.

Waste tyre disposal has become a major environmental issue in many countries. Each year more than 250 million used tyres are stockpiled in the United States, Rma, (2004) and Canada generates over 28 millions of passenger tyres per year, O'Shaughnessy & Garga, (2000). Korea has generated approximately 20 millions of waste tyres per year since 1998 and some of the tyres are utilized for rubber tiles, blocks or for cements materials. In Malaysia, the number of motorcar waste tyres generated annually was estimated to be 8.2 million or approximately 57,391 tonnes. About 60 % of the waste tyres are disposed via unknown routes.

In developing countries, there is a culture of reuse and recycling. Waste collectors roam residential areas in large towns and cities in search of reusable articles. Some of the products that result from the reprocessing of waste are particularly impressive and the levels of skill and ingenuity are high. Recycling artisans have integrated themselves into the traditional market place and have created a viable livelihood for themselves in this sector. The process of tyre collection and reuse is a task carried out primarily by the informal sector. Tyres are seen as being too valuable to enter the waste stream and are collected and put to use. (Gards, M. 2002).