



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**PSM TITLE: Design and Optimize The Interior Design and
Furniture Mechanism of Modular Unit of Food Truck.**

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

by

STUDENT NAME: MOHD AZIZI BIN AMAN

MATRIX NUMBER: B071410454

IC NUMBER: 950608-04-5311

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I hereby, declared this report entitled “**Design, and Optimize The Interior Design and Furniture Mechanism of Modular Unit of Food Truck**” is the results of my own research except as cited in references.

Signature :
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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 (Automotive) with Honours. The member of the supervisory is as follow:

.....

(Project Supervisor)

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ABSTRACT

This study discusses the design, analyze and optimize a structure based on food truck. The goals and objectives of this project are to design the new interior cabinets and furniture mechanism of food truck based on LEGO concept. Thus, event which is held every two years is recommended by the Universiti Teknikal Malaysia Melaka (UTeM). These designs are produced using Solid Work software to build a structure. The material that was used in this project were Aluminum steel. The interior and mechanism are then analyzed to determine the structure that produced a strong and sturdy when in testing on the road.

ABSTRAK

Kajian ini membincangkan reka bentuk, menganalisis, mengoptimumkan dan mereka-reka struktur yang berdasarkan trak makanan. Matlamat dan objektif projek ini adalah untuk mereka bentuk interior dan mekanism baru trak makanan berdasarkan konsep LEGO. Dengan itu acara yang diadakan setiap dua tahun disyorkan oleh Universiti Teknikal Malaysia Melaka (UTeM). Ini reka bentuk yang dihasilkan menggunakan perisian kerja pepejal (Solid work) untuk membina interior dan mekanism. Bahan yang digunakan dalam projek ini adalah aluminium. Interior dan mekanism ini kemudiannya dianalisis untuk menentukan struktur yang menghasilkan benar-benar kuat dan kukuh apabila diuji dalam ujian di jalan raya..

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CHAPTER 1

INTRODUCTION

1.1 Background of The Study

The interior and mechanism furniture are used to make sure that the truck or vehicle are fitted on their positioning when its move or make replacement and can be multi-purpose when using it. In the truck design interior and furniture mechanism there are consist of various type of design. Some use for food truck, charity truck, mini home and more. Food truck is the example of truck design of multipurpose used for selling things or food that are used by people now a day. It's too carry the food store, facilities and equipment for daily things. The food truck also can be as a restaurant. So, the space of the truck use be the main designing that be considered.

In my degree project, we use the food truck as the referral design to create a new design of interior design and mechanism furniture truck. The project is aim to design, and optimize modular furniture mechanism and interior food truck. The designing and the furniture mechanism of the is refer to food truck that already used now a day. It's can be adjusted, lightweight, load – carrying vehicle used by the already food truck and mini home. Based on project, the concept of designing is followed by the LEGO concept. Where the furniture mechanism can be adjusted or rebuild and become more area space of truck after the tow adjusted.

The interior design and furniture mechanism is built with various type of metal, and plastic that designing to all component are attach and fitted. The chassis frame is considered by the main purpose that must be lightweight and low cost. The chosen of materials are important to ensure that the flat form of chassis towing can withstand high and massive load.

The standard of interior design and furniture mechanism can carry various type load or heavy store giving it many used including re-supply and sells.



Figure.1 Standard of Interior Design and Mechanism

1.2 Problem Statement

The standard of interior and mechanism is used as the referral design for this project. We are design a new interior design and furniture mechanism to replace the standard of food truck design.

The interior design and furniture mechanism are already made by various type of materials that make them strong, can withstand a heavy load and make more places. But there are some criteria and designing part that they have considered. Which is there costing, materials used, weight, building, space and purpose.

Hence, our design is needing to convert and redesign a new product that can be acceptable and available in our country. In new design of interior and furniture mechanism it may different in size, used, weight and this will give a conversion to the chassis. The new design of food truck should: -

1. Easy to maintain and build
2. Light-weight and can withstand a heavy load
3. Modular
4. Low costing (maintenance/sells/spare parts/manufacturing). And good in material used

1.3 Objective

Basic design of the interior design and furniture mechanism of the truck are used in this project. We design a new system / modular to replace and redesign the interior and furniture mechanism of food truck. Some of the interior and furniture mechanism now a day are too heavy, expensive, can't be adjusted and have small places. The creation of the design project is followed by the based-on concept of the LEGO. So, our purpose that might be considered is the interior design and mechanism is easy to build, modular light-weight and most important is low cost in manufacturing.

1.4 Scope

The scope of this design project starts from designing structure of the interior design and furniture mechanism until the analysis of the structure. The overall scope of this project listed below: -

1. Used raw material that convenient in the manufacturing such as aluminium steel and plastic material of nylon 6.
2. The weight must be light than the standard of interior design cabinet and furniture mechanism.
3. Run the analysis by the Hyper Work and Solid Thinking.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

This purpose of this chapter is to provide the details and information about the ideal design of interior design and the furniture mechanism of food truck that used in automotive industries, the materials use for the design of food truck, furniture's, function elements, structure design and the comparison of the design of the project. In this section also show the fabrication process used for the joining the new design of food truck furniture and their parts.

2.1 History of Food Truck.

The history of the food truck can be referring from the America food truck where the idea of the mobile food on the street date back many years since the late of 17th century where it could be found in many of the larger cities on the east coast. Since that, the American street food and are part of ongoing revolution that the food truck has taken a front seat on that century. With the growing popularity of food trucks in the United States, some people tend to believe that the concept of mobile food is a recent invention. "Street Food" has been a part of the and has evolved from chuck wagons and push carts to trucks and even bustaurants. Though customers today have a chic and hip impression of the food truck industry, mobile food vendors and entrepreneurs started with humble and challenging beginnings.

The food truck idea sealing on street start with using the pushcarts. Pushcart and street vendor had difficult relationship with the local official. That is because had some of the issues that opposite with the laws and the limitation time to open the pushcarts and street vendors at the street since the 1600s. form that on 1707s, street food vendors were completely banned an effort to prevent congestion and due to complaints from retail stores and restaurants. But despite strict regulations, street food and other pushcart vendors continued to thrive in the city at that time as property owners and the police were agreeable to bribes.



Figure 2: Pushcart and Street Vendor

After that century come out with some invention in 1866 is attributed to Charles Goodnight, Texas cattle rancher. He modified an Army wagon and fitted the truck with the storage drawers with kitchenware and food supplies. Other name that modified the design is Walter Scott where his covered the wagon by adding the windows and that followed by others idea and Thomas H. Buckley start manufacturing various model that featured refrigerators cooking stoves and sinks.



Figure 3: Army Wagon Food Truck

The invention of automobiles also had an impact to the evolution of the mobile food industry. Mobile canteens, which at this point nearly resembled modern food trucks, around 1960s, bigger food trucks started selling familiar products like tacos and burgers to blue-collar locations like construction sites and factories. Around 2000s, the negative reputation of mobile food disappeared as creative businesses started to attract attention. Ethnic and fusion cuisines have become popular wares of food trucks and with online technology, entrepreneurs connected to more customers than ever before. Probably one of the most successful and inspiring food truck businesses is Kogi Korean BBQ. Combining Mexican and Korean food, Kogi grew from a single food truck operation in 2008 to a fleet of five trucks today. The creativity and innovation, a mobile food business may even set the trend and redefine an industry. (<http://mobilecuisine.com/business/historyofamericanfoodtrucks/>)



Figure 4: KOGI Food Truck

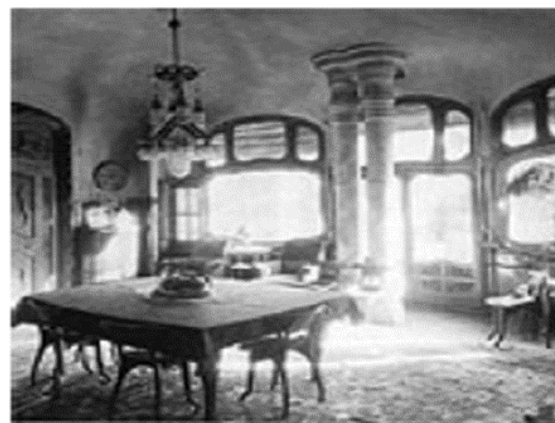
2.2 History of Interior Design

In this era, interior design or space are such an important thing for human life experiences. Usually most people love that design with open space that can have good environment and can give good air also large views. It's can give more comfortable and being enjoy reflected the reality that so much of life spent inside. The planning design can have figured and influence on the activities and live as long as they continue in use. The research of interior design, its development and change through history is a useful way both to explore the past and to make sense of the spaces in which modern life is lived. Professional interior designers are expected to study design history, to know the practices of the past in terms of "styles," and to know the names and the nature of the contributions of those individuals who generated the most interesting and influential approaches to design.

(http://www.architectureweek.com/2001/0905/culture_11.html)



Charles Rennie Mackintosh, Hill House, Helensburgh, Dunbartonshire, Scotland, 1902-03.
Photo: RCHMS, photo 1904 neg no DB/580



Antoni Gaudí, Casa Batlló, Barcelona, 1904-06.
Photo: Courtesy John Wiley & Sons

Figure 5: First Idea Interior Design

The analysis of the ergonomic, functional and the sociocultural approaches are relevant aspects merged, based on users they can make their perception and experts evaluation about the interior design of semi-heavy and heavy truck sleeper cabins sold, considering the suitability for objects storage, sleeping, resting and living, feeding, personal care, communication, entertainment. After many truck cabins analysis, it was noticed that the interior design of truck cabins is not always adequate to their users in terms of usability, ergonomics and comfort. The interest in the topic came from the professional experience of the ergonomist in truck cabins development in the automotive industry.(Paula, Mello, Ventura, & Dantas, 2015)

Truck purchasers aren't constantly its users. For fleet proprietors, vehicles are basically equipment, and components directly related to the cost/benefit are more vital to a buy selection than usability, ergonomics and consumer consolation issues. on the other hand, whilst drivers are the proprietors of the trucks, these problems turn out to be extra relevant for a purchase choice, because truck cabins are their administrative center and brief housing. Advertising and post-sales researches, maximum of the instances, are directed to purchasers, who aren't always truck customers and do now not have the revel in of the actual use of the product. Vans are worldwide market merchandise, but should adapt to the peculiarities of the local markets wherein they may be used. How to tailor initiatives to the range of users of their anthropometric, cultural, social and behavioral factors.



Figure 6: Standard Interior Design of Food Truck

Basically, the designer of the interior design making design based on the owner or customers the create their own layout of the interior. Addition, the interior design is followed by their what storage or cabinet that they want to fit into the interior of food truck. By the way, the size and space be the main factors that must be considering to fitted into the cabin.

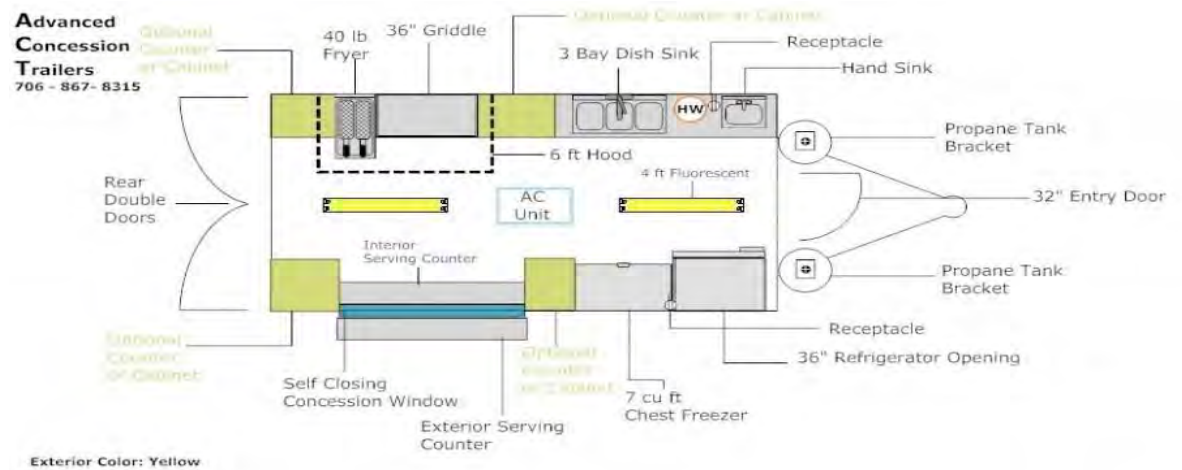


Figure 7: Basic Layout of Interior Design

2.3 Type of Steel for Manufacturing.

2.3.1 Introduction of Steel

Back to 2000 BCE started production of the iron by the human, then the Iron Age are beginning. At this age there are used iron to implement and make weapon with replaced bronze. Iron ore are naturally existing that make the iron is the fourth most abundant element that have more than five percent in earth crust. There are many process that can make the iron change their structure to achieve more specific about the iron and steel. Within the past, more than 100 years, the metallurgist have learnt how to make a steel, studies their properties and structures and qualities.

Every iron and steel have difference consist of carbon in their properties such as wrought iron (“wrought” means “worked” that is hammered). Wrought iron tough and malleable that contained carbon from 0.02 percent to 0.08 percent generally. Other, the iron that hard and brittle and contained 3.0 to 4.5 carbon is from cast iron. (Spoerl, 2016) This iron are heated at high temperature and some radical change by the absorbed the carbon rapidly. Then the melting of this metal is low where the content of the carbon is high.

Pig iron, is other iron that produce by the cast iron where molten cast iron directly forms the blast furnace. Blast furnace is the chimney-like structure that combust the air pumped through alternating layer of charcoals, flu and iron ore. The sand trough by small number of lateral trough, suckling little of piglet are configured resemble cast iron make produced pig iron. In the middle of the ages the ironmaker learn how to transform the cast pig iron that might be useful of wrought iron by oxidizing excess carbon out of the pig iron in charcoal furnace that process called finery.

Steel have 0.2 to 1.5 contained of carbon that make the steel are more harder ta the wrought iron but not brittle better than cast iron. (Spoerl, 2016)The flexibility and tensile strength combination of hardness make the steel is more useful than either type of iron. steel is softer than wrought iron not enough durable and holds a sharp edge and the tension and resist shock better than more brittle cast iron. Steel are difficult and expensive at the mid of 1800s. By the production of the steel there are steel such as blister steel and crucible steel. Blister steel are made up by the heated and brought under a forge hammer to ensure the consistent texture. Others, crucible steel their other process that be made to produce it where the blister steel could be melted in clay crucible and some addition of special flux that removed the fine particles of slag that cementation process cannot remove it. Cementation process is the invention by the Bessemer converter. Yet, that process make the crucible steel are more expensive and high quality.

In 1856, Sir Henry Bessemer invented the British metallurgist are invented the Bessemer process that generate cheap steel production. He was designed the converter, a large, pear-shaped receptacle with hole at the bottom to allow the injection of compression of air. Bessemer filled it with molten pig iron, blew compressed air through the molten metal, and found that the pig iron was indeed emptied of carbon and silicon in just a few minutes; moreover, instead of freezing up from the blast of cold air, the metal became even hotter and so remained molten.

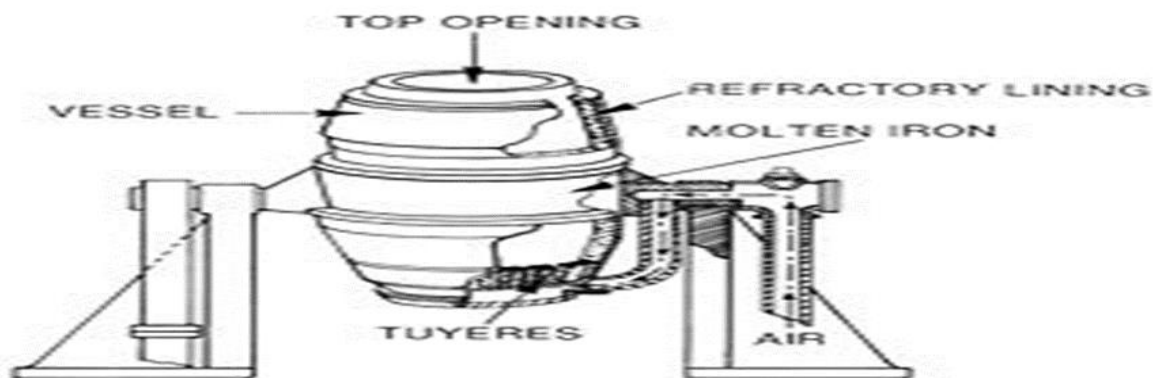


Figure 8: The Bessemer Converter Component



Figure 9: Bessemer converter, Kelham Island Museum, Sheffield, England (2010)

Based on the Bessemer process pig iron does not remove the phosphorus. Steel excessively brittle made by phosphorus. Initially, phosphorus-free ores that made by the pig iron used as based on that only could done by the Bessemer process. They only found at few places that make such ores are relatively scarce and expensive. In 1876, the Welshman Sidney Gilchrist Thomas discovered that adding a chemically basic material such as limestone to the converter draws the phosphorus from the pig iron into the slag, which floats to the top of the converter where it can be skimmed off, resulting in phosphorus free steel. This is called the Thomas basic process This crucial discovery meant that vast stores of iron ore from many regions of the world could be used to make pig iron for Bessemer converters, which in turn led to skyrocketing production of cheap steel in Europe and the U.S.

Steel have high tensile strength, its make steel are usually used on construction and many application in industries because his properties and low cost. Steel is an alloy of iron and combination with carbon. Steel's base metal is iron, primarily carbon, that

gives steel and cast iron their range of unique properties. The commonly method to produce steel by the oxygen furnace. It will have produced more stronger metal by the removal the impurities of the iron. vey pure oxygen blow through melted iron and lowers the level of impurities. Some of the metal are added by chemical to improve their properties such as stainless steel that make the steel can't be rust. Steel's strength compared to pure iron is only possible at the expense of iron's ductility, of which iron has an excess.



Figure 10: The Furnace Oxygen

Before 17th century the steel is produced in bloomery furnace, after that blister steel and crucible steel are produced with more efficient production method has begun. With the invention of the Bessemer process in the mid-19th century, a new era of mass-produced steel began. This was followed by Siemens-Martin process and then Gilchrist-Thomas process that refined the quality of steel. With their introductions, mild steel replaced wrought iron.

From the history their such many idea and process that can make the steel and his technic. The mixture of the element with the iron that give the impact and effected the changes the properties and material structure result make the various of steel produced. The properties of the steel give enhancement to the steel strength because the increases of carbon on it. Today, steel is one of the most common materials in the world, with more than 1.3 billion tons produced annually. It is a major component in buildings, infrastructure, tools, ships, automobiles, machines, appliances, and weapons. Modern steel is generally identified by various grades defined by assorted standards.