
# UNIVERSITI TEKNIKAL MALAYSIA MELAKA

## ERGONOMICS ASSESSMENT OF AUTO REPAIR JOB

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Manufacturing Engineering (Manufacturing Management)

By

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# UNIVERSITI TEKNIKAL MALAYSIA MELAKA

## BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

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I hereby, declared this report entitled "Ergonomics Assessment of Auto Repair Job" is the results of my own research except as cited in references.

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# APPROVAL

This report is submitted to the Faculty of Manufacturing Engineering of UTeM as a partial fulfillment of the requirements for the Degree in Bachelor of Manufacturing Engineering (Manufacturing Management). The member of the supervisory committee is as follow:

.....

Principle Supervisor

# ABSTRAK

Kerja membaiki kereta melibatkan satu pekerjaan fizikal yang berat**.** Dalam sejarah automotif**,** kerja pembaikan kereta pada dasarnya adalah sama. Ianya melibatkan kedudukan pelik dan beberapa tekanan kerja yang menganggu musculoskeletal pada para mekanik. Penilaian ergonomic ini telah dijalankan pada dua buah bengkel kereta yang berbeza yang beroperasi sekitar Melaka. Selain itu penilaian terhadap peralatan tangan juga turut dilakukan pada para mekanik. Keputusan yang di perolehi adalah ternyata terdapat gangguan pada kedudukan pelik semasa menjalankan kerja-kerja pembaikan kereta. Terdapat juga alatan tangan yang memang ternyata tidak sesuai digunakan oleh para mekanik. Akhir sekali cadangan pembaikan untuk mekanik juga telah di perkenalkan. Diantaranya kadar rehat yang mencukupi pada para mekanik, shift berkerja dan juga penggunaan peralatan tangan yang betul bagi mengurangkan tekanan tenaga kerja.

# ABSTRACT

Auto repair involves heavy physical labor. The work of auto repair remains essentially similar throughout the history of automobiles, it involves awkward positions and excessive amounts of exertions which results in musculoskeletal disorders for many mechanics. An ergonomics assessment of auto repair was conducted at two auto repair shops in Malacca. Apart from that, a hand tool evaluation was performed as well. Results indicated that mechanics assumed awkward postures all the time when performing auto repair tasks. Some hand tools used by the mechanic did not conform to the ergonomic principles of hand tools. Proposed improvements for the mechanics include the introduction of frequent rest breaks, job rotations, and proper hand tools to minimize physical exertions

# DEDICATION

***To my beloved mother, father and friends, thank you for the support and encouragement***

***and***

***For my lecturers, especially for my Supervisor of Project Final Year***

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| | |
|---|---|
| NIOSH | - National Institute for Occupational Safety and Health |
| MMH | - Manual material handling |
| MSDs | - Musculoskeletal Disorders |
| CTDs | - Cumulative trauma disorders |
| RSI | - Includes repetitive strain injuries |
| OS | - Overuse strain |
| OOS | - Occupational overuse syndrome |
| RMDs | - Repetitive motion disorders |
| WRMSD | - Work related musculoskeletal disorders |
| EMG | - Electromyography |
| MSDS | - Musculoskeletal Disorders |
| MMH | - Manual material handling |

# CHAPTER 1
# INTRODUCTION

Chapter 1 will give a brief explanation about this project, starting with the background of the project title, "Ergonomic Assessment during Auto Repair Job". This chapter will also discuss about the problem statement, the objectives and the scope for this project.

## 1.1 Background Of Study

Nowdays, the automotive industry is one of the largest most influential, and labour intensive industries. It also influent the auto repair job in all over the world. The core activity within the auto repair job is the repairing the car or other damage happened. Simply viewed, this works can be described as a purpose driven, intentional interaction between matter, technology and an individual who is interacting with environment

Ergonomics, which referred to as human engineering, is designed to improve the relationship between workers and the work environment. In order to know how effectively the human hazard at automotive site is utilizing ergonomics need to implement an ergonomic assessment. Major human hazard during auto repair job at automotive areas ergonomic exposures of service technicians is Segmental vibration, contact stress of the palm, and awkward postures, including extreme shoulder elevation have all been studied as isolated exposures. An ergonomic assessment of workplace can reveal any unsafe or problem areas, identify ergonomic solutions, and help the implement an ergonomic plan of action that will improve the overall ergonomics in the workplace.

The comfortable and environment of working at the workplace, reduced injuries, avoid risk factor and also reduce the time of working. Job related psychosocial factors have been receiving increasing attention as potential significant etiologic factors of musculoskeletal disorders and morbidity. These risk factors included repetition, forceful exertions, awkward postures, contact stress, cold temperature exposure, and segmental vibration. Ergonomic hazards were identified in the work of automotive service technicians. Physical exposures included awkward postures as specified by different positions of the technician in relation to the vehicle being serviced, excessive force in both upper and lower extremities, and segmental vibration. Although ergonomic assesment is consideration for the automobile worker (design for manufacturing to prevent musculoskeletal disorders) are factors in vehicle design, design for maintenance appears to be neglected. This project is to improve the workplace, equipment, and environment and help to improve the safety of workers, health and well being of the workers using ergonomic assessment.

## 1.2 Problem Statement

The ergonomic hazard in automotive worksite is so related with predominant physical stressors included awkward postures, excessive force, and exposure the right posture during auto repair job situation. The situation can give a risk for the workers and also will be effects the performance. This situation leads to tiredness and back pain for the workers. Therefore in this study an ergonimics asesessment will be carried out to improve the working conditions in auto repair jobs. There have five (5) element of work system, the individual, task, technology and tools, environment and organizational factors. Ergonomics assessments is used for automotive workshop is to achieve an appropriate balance between worker‟s capabilities and work requirement to optimize worker‟s operations to auto repair job situation. The total system as well as provide worker‟s physical and mental well-being, job satisfaction and safety. The better technique will be implementing to solve the problem during auto repair job operations.

## 1.3 Objective

The aim of this study is to:

a) To perform ergonomics assessment in auto repair shops via observation method;
b) To evaluate common hand tools used in auto repair tasks;
c) To propose ergonomics improvement in selected auto repair tasks.

## 1.4 Scope

The project is too investigates the awkward posture during auto repair job operations at workshop that reduced injuries, avoid risk factor and to improve the workplace, and environment and help to improve the safety of workers The people involved is the service technician. So, the project focuses to analyze working posture and using observation method. This project will analyze, revise, and recommend a new technique as solution to improve present working posture. Apart from analyzing postures, the common hand tools used in auto repair will also be evaluated. Powered hand tools are not evaluated in this study.

## 1.5 Potential Benefits of Study

The potential benefits from the study. Firstly for the workers, this project may help the worker to protect the own safety during auto repair operations. This experiment may change the correct postures using observation method while the workers do the job and give the comfortable for workers. Workers can avoid the body from tiredness and protect their own healthy. Lastly for the students, this ergonomic project will increase knowledge on ergonomic based on real situation in working area. Student can learned to use the correct method to implement the real life. Student also may help the service technician to reduced injuries and comfortable working environment during the task.

## 1.6 Structure of the Report

As for PSM, this report will be segmented into five chapters. The first chapter is the introduction of the report. It generally discusses about the background of study, problem statement, scope, objectives as well as the limitation of the study, importance of study:

(a) Chapter 1

Chapter one is a introduction of the project, that consists the background of the study, problem statement, objective project, scope of study, potential benefits of study and structure of the report.

(b) Chapter 2

Chapter two is the literature review which will be done based on journals, books, internet resources and previous studies done on the related topics. It consists of the literature review about the theoretical concept of ergonomics. Background study on the evolution of ergonomics science is shown. The relationship between auto repair job activities and occupational health and types of safe working posture also the illness and injuries. Reviews are done on auto repair job which are suitable to be used for this project.

(c) Chapter 3

Are described details of the case studies that workers associated with manual activities. This chapter also consists of data analysis from experiments and observation results. The comparison on the effectiveness of current and proposed working posture and the effects on the workers activities to increase the productivity also will be briefly explained.

(d) Chapter 4

Describe details about the effectiveness of implementation of method, during auto repair job situation.

(e) Chapter 5

Is the final part of the project, which concludes the final year project. This chapter will conclude the study objective and suggestion on future work.

# CHAPTER 2
## LITERATURE REVIEW

### 2.1 Introduction of Ergonomic

The history of ergonomics goes back to the early part of this century when people began to study the relationship between people and their working environment. The name comes from the Greek: *ergo*, meaning work and *nomics* meaning laws (Robert A. Vance, 1999) . By the middle of this century, the field included experts from medicine, psychology, and engineering. Ergonomists have developed new ways for people to perform their tasks more comfortably and productively by studying the effects of force, posture, vibration, and repetition on the human body. Individual programs have resulted in increased productivity, lowered workers compensation claims and absenteeism, and increased job satisfaction. Despite these gains, many people each year develop disorders.Ergonomic involved with human behavior and attributes such as decision making process, organization design, human perception relative to design became known as cognitive ergonomics. The knowledge that involved physical aspects of the workplace and human abilities such as force required to lift, vibration and reaches became known as industrial ergonomics or ergonomics.

Working posture is a vital component of ergonomic design. This lack of workplace assessments makes it difficult to determine optimal working postures or to prevent hazardous working postures. In all working postures there is an interaction between the operator and the machine.

Humans and machines are generally adequate when seen as separate entities, but it is the interface between the two that is of vital importance to industry. Ergonomics

defines itself as a science which aids in the designing of the task, tools and work environment to suit the capabilities of the workforce (Andrew Brent Elliott,2007).

## 2.2 Working Postures

Many work situations during auto repair job is impose constraints on workers and force individuals to adopt awkward work postures, and to maintain these for the duration of the task thereby increasing the risk of incurring a Musculoskeletal Disorders. These postures may also need to be held for a certain period of time, requiring static standing and restricted postures such as those found in workshop during auto repair job situation. These risk factors included: repetition, forceful exertions, awkward postures, contact stress, cold temperature exposure, and segmental vibration(J.E.Gold,2009). It quickly became obvious that the workers assumed a limited number of positions in relationship to the vehicle. Each of these positions was associated with a specific set of awkward posture and contact stress risk factors, independent of the task being executed. These risk factors were modified by the size of the vehicle and to a lesser extent by the size of theservice technician.(S. Fulmer,2009).

Most work on a workstation is performed close to the body and involves standing positions and strenuous forced postures, with relatively low levels of forces being applied. When utilising testing tools, however, tasks are performed further from the body and higher force application is required (Winter *et al.*, 2006). Standardised the working postures can however lead to inaccurate predictions of the actual forces and postures which occur in everyday life, and therefore the most suitable way of assessing human force exertion for research and design is in a free posture. A standard posture is however considered to result is more reliable data (Daams, 1993). With specific static of postures, most often utilised in experimental studies, in practice they do not occur very often. In workstation area, static postures are broken by small movements and many work situations also allow for the body to be supported by structures in the work environment or the actual machine or device being utilised or assembled.

It is important to consider to reduce the possibility working of developing the WRMSDs. During automotive repair or auto repair job situation, a workers may be situated either inside of or outside of the vehicle being serviced. Other positions such as those assumed during tasks such as wheel balancing or servicing an engine transmission after removal from the vehicle are independent of the vehicle location. The position along with related risk factors identified through observation are presented in table 2.1. The scheme allows for uncommon positions to be added as observed.

**Table 2.1**: Position of Wokers Technicians and Associated Posture and Contact Stress Hazards

| **Position** | **Ergonomic Hazard or awkard posture** |
|---|---|
| Under vehicle | Shoulder elevation, back extension, neck extension, static holding. |
| Under vehicle (vehicle on floor) | Shoulder elevation, neck extension, static holding |
| Side of vehicle | Possible awkward arm and wrist postures |
| Side of vehicle (vehicle on floor) | Kneeling |
| Under hood | Back flexion with static holding, awkward arm and wrist postures, shoulder elevation contact stress for legs and chest |
| Changing tires | Shoulder elevation, back extension, neck extension, static holding and kneeling |
| Under dash | Back extension, neck extension, shoulder, elevation, awkward arm and wrist postures, static holding, contact stress for back |

## 2.3 Risk Assessment

A risk assessment for workstation during auto repair job situation. The risk must be analysis method allowed for the overall risk categorisation of a task to be reported and an observation period of all tasks on the auto repair job ensured the identification of problem areas and facilitated in the quantification and categorisation of the risks.Risk analysis is a survey method developed for use in investigations of workplaces which have an occurrence of upper limb disorders and to be analysis of medical records indicated a prevalence of upper limb disorders thus its use in this study.

This obvservation method are survey methods used in ergonomics investigations where postural loading is a concern. They are based on observations of working postures during auto repair job situation. (Andrew Brent Elliott,2007).

## 2.4 Musculoskeletal Disorders (MSDS)

Musculoskeletal Disorders (MSDs) are injuries of the muscles, nerves, tendons, ligaments, joints, cartilage, or spinal discs. MSDs are not typically the result of any acute event but reflect a more gradual or chronic development. Overload of muscles, joints and other supporting structures of the musculoskeletal system by adopting awkward body postures may result in MSDs, also known as work-related musculoskeletal disorders (WRMSDs), CTDs, or repetitive strain injuries (RSIs). (Andrew Brent Elliott,2007). MSDs of the upper extremity and low back disorders have also been found to be strongly associated with exposure to combined ergonomic stressors and the type of work performed (Andersson, 1997; NIOSH, 1997). Scientific evidence has shown that physical and psychosocial factors are critical to consider when looking at the development of WRMSDs (Dempsey, 1998). Especially of the lower back, neck, shoulders, arms and hands.

The cause for the development of MSDs, including awkward postures, poor work organisation, fast work pace, high stress, previous pain symptoms, prolonged static load on the muscles, movements, exerted forces and the combination of these factors.the awkward postures including lower back pain, heavy physical work,