UNIVERSITI TEKNIKAL MALAYSIA MELAKA

ASSESSMENT OF WHOLE BODY VIBRATION EXPOSURE AMONG METAL STAMPING OPERATORS

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

by

NUR AINIEYANTIE BT KAMARUDDIN

FACULTY OF MANUFACTURING ENGINEERING

2008

DECLARATION

I hereby, declared this report entitled "Assessment of Whole Body Vibration Exposure among Metal Stamping Operators" is the results of my own research except as cited in references.

Signature	:	……
Author's Name	:	NUR AINIEYANTIE BT KAMARUDDIN
Date	:	……

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Cop Rasmi:
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.....

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NOR AKRAMIN BIN MOHAMAD
Pensyarah
Fakulti Kejuruteraan Pembuatan
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ABSTRACT

Generally, these studies discuss the whole body vibration experienced among machine operators during metal stamping process. The objectives of the study are to identify pain, discomfort and occupational injuries that experienced by the stamping machine operators due to whole body vibration exposure**,** to analyze the WBV exposure experienced by the stamping machine operators during metal stamping process and develop solution to eliminate or reduce whole body vibration exposure. The study was carried out among the machine operators in a metal stamping industry. Ergonomic approach was used as the methodology to achieve the objectives. During the study, three phases assessment which involved measurement of whole body vibration, observation method, whole body vibration measurement and whole body vibration measurement using a rubber pad were conducted. Based on the survey, the author was identified that most of machine operators experienced pain, discomfort and occupational injuries while performed their task. This study has been conducted based on Design of Experiment 2^3 with two levels of each factor is used. The factors used are machine capacities, machine speeds and working positions. According to the results obtained from the assessment without using any control measure, machine speed was identified as the significant point that contribute to occupational health problems. The design of workstation has been improved using a rubber pad as a solution to reduce whole body vibration exposure. Therefore, the author concluded that a propose control measure is an effective solution to the occupational health enhancement in metal stamping industry.

ABSTRAK

Secara umumnya, kajian ini membincangkan dan mengenalpasti mengenai getaran keseluruhan badan yang dialami oleh operator mesin semasa proses menghentak logam. Objektif dalam kajian ini adalah mengenalpasti sakit, ketidakselesaan dan kecederaan semasa bekerja, menganalisis pendedahan getaran keseluruhan badan yang dialami oleh operator mesin menghentak semasa proses menghentak logam dan membangunkan satu penyelesaian untuk mengurangkan pendedahan kepada getaran keseluruhan badan. Kajian ini dijalankan dikalangan operator mesin yang terlibat dalam industri menghentak logam. Pendekatan ergonomik telah digunakan sebagai kaedah kajian untuk mencapai objektif dalam kajian ini. Semasa menjalankan kajian ini, terdapat tiga fasa penilaian yang terlibat iaitu kaedah pemerhatian, kaedah pengukuran getaran keseluruhan badan dan kaedah pengukuran getaran keseluruhan badan dengan menggunakan getah pelapik. Kajian ini telah dijalankan berdasarkan Rekabentuk Ekperimen 2^3 dengan 2 level bagi setiap faktor. Faktor-faktor yang digunakan adalah kapasiti mesin, kelajuan mesin dan posisi bekerja. Berdasarkan tinjauan yang dibuat, penulis telah mengenalpasti bahawa kebanyakkan operator mesin mengalami sakit, ketidakselesaan dan kecederaan semasa bekerja. Selaras dengan keputusan yang diperolehi, penilaian terhadap kaedah pengukuran tanpa menggunakan sebarang cadangan penambaikkan telah terbukti bahawa kelajuan mesin telah menyumbang kepada masalah kesihatan. Walaubagaimanapun, rekabentuk kepada tempat kerja yang telah ditambahbaikkan dengan menggunakan pelapik getah di atas lantai adalah terbukti mengurangkan pendedahan kepada getaran keseluruhan badan. Akhir sekali, penulis telah membuat kesimpulan bahawa cadangan penambahbaikkan adalah penyelesaian yang efektif kepada peningkatan mutu kesihatan semasa bekerja dalam industri menghentak mesin.

DEDICATION

I would like to dedicate this report to my father, my mother, my sister and my brothers

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CTS	-	Carpal Tunnel Syndrome
DOE	-	Design of Experiment
DOSH	-	Department of Occupational Safety and Health
EU	-	European Community Directive
HAV	-	Hand Arm Vibration
HOQ	-	House of Quality
HSE	-	Health and Safety Executive
ISO	-	International Organization of Standard
LBP	-	Low Back Pain
NIOSH	-	National Institute for Occupational Safety and Health
PC	-	Personal Computer
QFD	-	Quality Function Deployment
R.M.S	-	Root Mean Square
TLV	-	Threshold Limit values
WBV	-	Whole Body Vibration

CHAPTER 1
INTRODUCTION

Chapter 1 provides information on background of study, identified problem statements and information on study requirements. In the study requirements, the objectives of study and study questions are presented. This chapter is also provides the explanation about the scope and limitation of study, potential benefits from the study as well as outline of the conducted study.

1.1 Background of Study

Nowadays, manufacturing industry is leading most industry in Malaysia. The industry includes automobile industry, metal stamping industry, metal casting industry, mould and die industry and others. The metal stamping industry is well-established in Malaysia, supplying stamped/pressed parts to a wide range of industries, including the electrical & electronics, automotive, industrial machinery and equipment, precision measuring and testing equipment. This industry is now heading towards advanced technologies and the provision of total solutions including prototypes, moulds and dies and sub assembled components. The steady increase in the demand for electrical and electronic products and automotive components will continue to spearhead the growth in the metal stamping industry in Malaysia. There are over 300 companies engaged in metal stamping activities as technological advances and a steady increase in demand continue to drive the need for expansion within the industry.

In metal stamping industry, almost machine operators have to perform stamping process using multi machine capacities. In general, capacity of stamping machine can be classified into three types; low capacity, medium capacity and high capacity. During metal stamping process, the machine transfers its vibration to entire body of operator. This phenomenon is called as whole body vibration (WBV) exposure.

It is well known that WBV affects the occupational health of machine operator (Anonymous 2000). Operators who are exposed to WBV for a long period may experienced pain, discomfort and occupational injuries. If these symptoms let be repeated and exposed to prolonged time, the operator will be experienced severe occupational injuries such as low back pain and carpal tunnel syndrome. Figure 1.1 illustrates the exposure of a machine operator to WBV during metal stamping process.

Figure 1.1: A machine operator is exposed to WBV during metal stamping process.

Realizing the needs to manage efficiently WBV exposure, the author was conducted a case study on assessment of WBV among stamping machine operators. Observation method and direct measurement method have been applied to assess the exposure of WBV among the machine operators. Observation method associated with a modified Nordic Musculoskeletal Questionnaire was distributed to the stamping machine

operators to determine their judgment on WBV, while Human Vibration Meter was used as a tool to measure the frequency-weighted experienced by those operators.

As a control measure for the WBV, the author has proposed rubber pad platform to reduce the risk of WBV. Rubber pad platform was placed on the floor, so that the operator stands on it during stamping process. The main purpose of rubber pad platform is to absorb the vibration generated by stamping machine thus, reduced the exposure of WBV.

1.2 Problem Statement

The vibration that generated by the metal stamping machine has been proven to result in musculoskeletal disorders symptoms of the hand, arm, and another parts of the body. Among others identified significant problems relating to WBV are summarized as follow:

a) Long-term occupational exposure to WBV is associated with an increased risk of disorders of the lumbar spine (low back pain) and injuries on the connected nervous system (Bovenzi M. *et al.,* 2002).
b) It is believed that workers who are exposed the WBV, their morale and psychology will be affected. They tend to withdraw from the job, moody and less concentration while working (Anonymous 2000).
c) The effects of whole body vibration were also contributed to finance impact whereby company has to spend an extra cost for medical treatment and compensation (Anonymous 2008).

1.3 Study Requirement

In order to create safe working practices in metal stamping industry, it is necessary to provide solutions to the mentioned problems. This section addresses the objectives of study and questions being investigated in the study regarding to WBV associated with metal stamping process.

1.3.1 Objectives

This study tries to achieve the following objectives:

a) To identify pain, discomfort and occupational injuries that experienced by the stamping machine operators due to WBV exposure**.**

   Workers who are exposed to whole body vibration potentially exposed to health problems. Moreover, the productivity of the company may also decrease. The machine operators will be interviewed to determine any difficulties that they experienced.

b) To analyze the WBV exposure experienced by the stamping machine operators during metal stamping process.

   The frequency of the vibration due to metal stamping process is measured and analyzed by comparing the measured data to the Guidelines on Occupational Vibration. By referring the guideline, exposure of stamping machine operators to WBV could be justified.

c) To propose a control measure to minimize the risk of whole body vibration exposure

   Since the WBV directly affecting operator's health, a control measure needs to propose to minimize the exposure of WBV during metal stamping process.

1.3.2 Study Questions

The questions being investigated in the study are as follow:

a) What sort of pain, discomfort and occupational injuries experienced by the workers during metal stamping process?

b) Is any significant different in term of WBV exposure when the operators perform the metal stamping process through following work setting:
   i. Machine capacity (low machine capacity and high machine capacity).
   ii. Working position (standing working position and sitting working position).
   iii. Machine speed (low machine speed and high machine speed).

c) Does the proposed solution is effective to reduce the WBV exposure during metal stamping process?

1.4 Scope and limitation

1.4.1 Scope

During metal stamping process, two capacities of machine are measured:

- Low machine capacity (60 tons)
- Medium machine capacity (300 tons)

For each machine, two speed rates are investigated.

- Low speed
- High speed

The measurement is also considering working position of operator whereby seated and standing working positions is assessed.

1.4.2 Limitation

The author has proposed and implemented a 'rubber pad' as a control measure to minimize WBV exposure. However, the implementation of the proposed control measure is depending on company willingness to deploy the solution. Furthermore, the author only conducted the study on WBV at low machine capacity and medium machine capacities.

1.5 Potential Benefits

The aims of this study are to assess WBV that experienced by the stamping machine operators and propose a solution to reduce the risk of WBV while metal stamping process. With such efforts, the study may offer several potential benefits to following parties:

a) University

The findings of study will be documented in a report and published in University library. Students who interested to perform the study related to WBV may use the report as a reference.

b) Industry

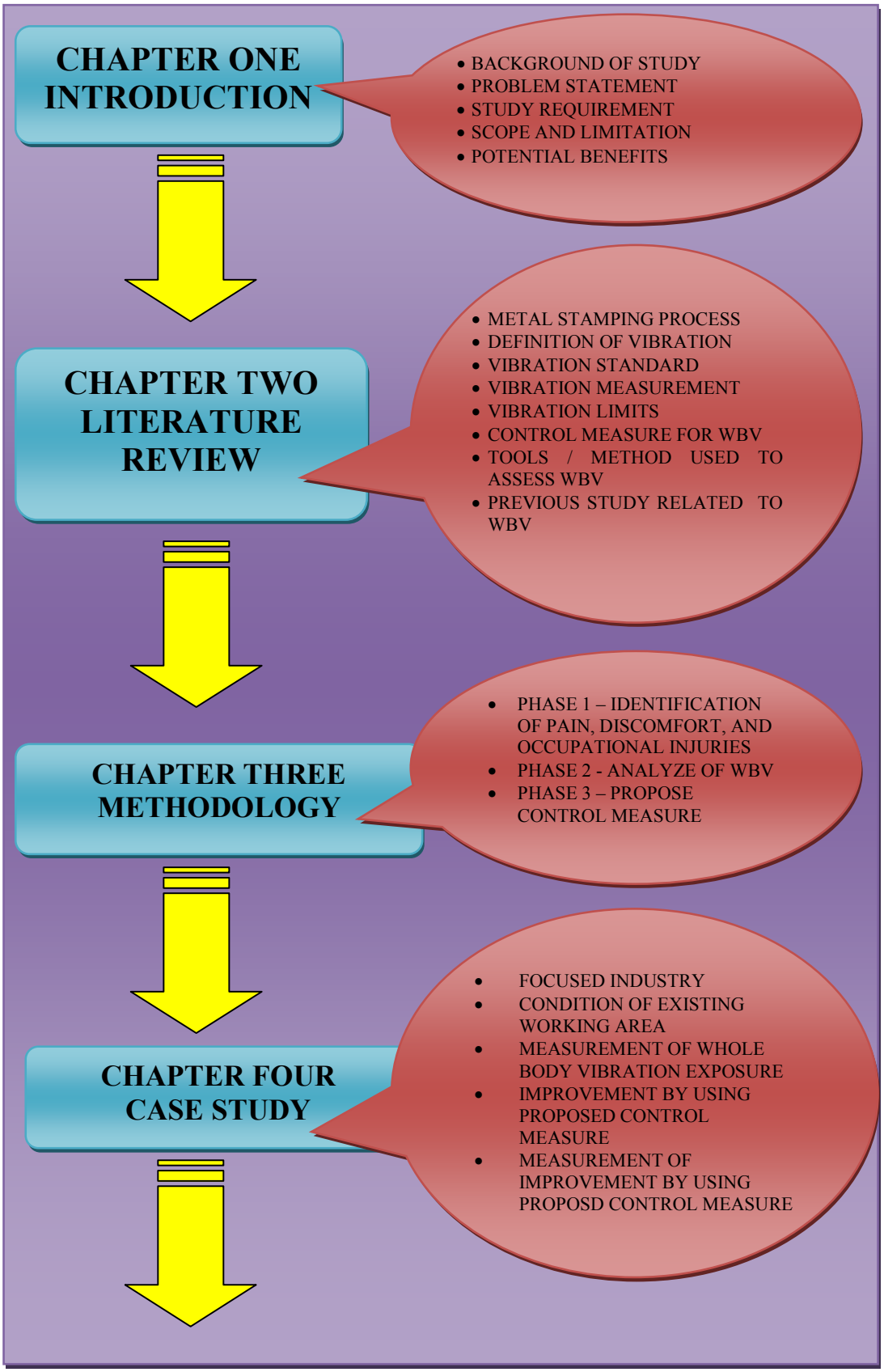
This study provides a measurement technique in investigating the whole body vibration exposure during metal stamping process. This information can be utilized by the industrialists to manage their workplaces safe and healthy.

c) Students

This study may help students improve understanding on assessment of WBV and provides real industrial experience because all related assessments have been carried out within the real industry.

1.6 Report Outline

In general, the structure of this report is organized into three chapters namely (i) Introduction (ii) Literature Review (iii) Methodology (iv) Case Study (v) Results and Discussion (vi) Summary and Conclusion (vii) Suggestions for Future Study. Figure 1.2 illustrates a guided flow of information within the structure of the report. The first chapter outlines the background of the study which encompasses the information of whole body vibration exposure among machine operators' issues. Chapter two explains whole body vibration especially definition of vibration, vibration standard, vibration limits and vibration measurement. This chapter also gives an overview of existing tools or methods used to assess WBV. Chapter three focuses on the study methodology adopted in this study. It explains how this study identifies pain, discomfort and occupational injuries experienced by the machine operators during metal stamping process. It also described the procedures and analyzes the WBV measurement. At last section in this chapter explains the method to propose control measure to minimize the exposure of WBV. Chapter four explains the case study of the study. It deals from general study to specific. Chapter five relates to the finding of the study. The results of conducted whole body vibration measurement are presented and the assessment of whole body vibration using a rubber pad is measured. Chapter six summarized and concludes the study findings. The potential occupational health problems to metal stamping operators are identified and highlighted. The final chapter is addresses several suggestions for future work. The final chapter, chapter seven addresses several suggestions for future work. It compasses the improvement on administrative control and engineering control.



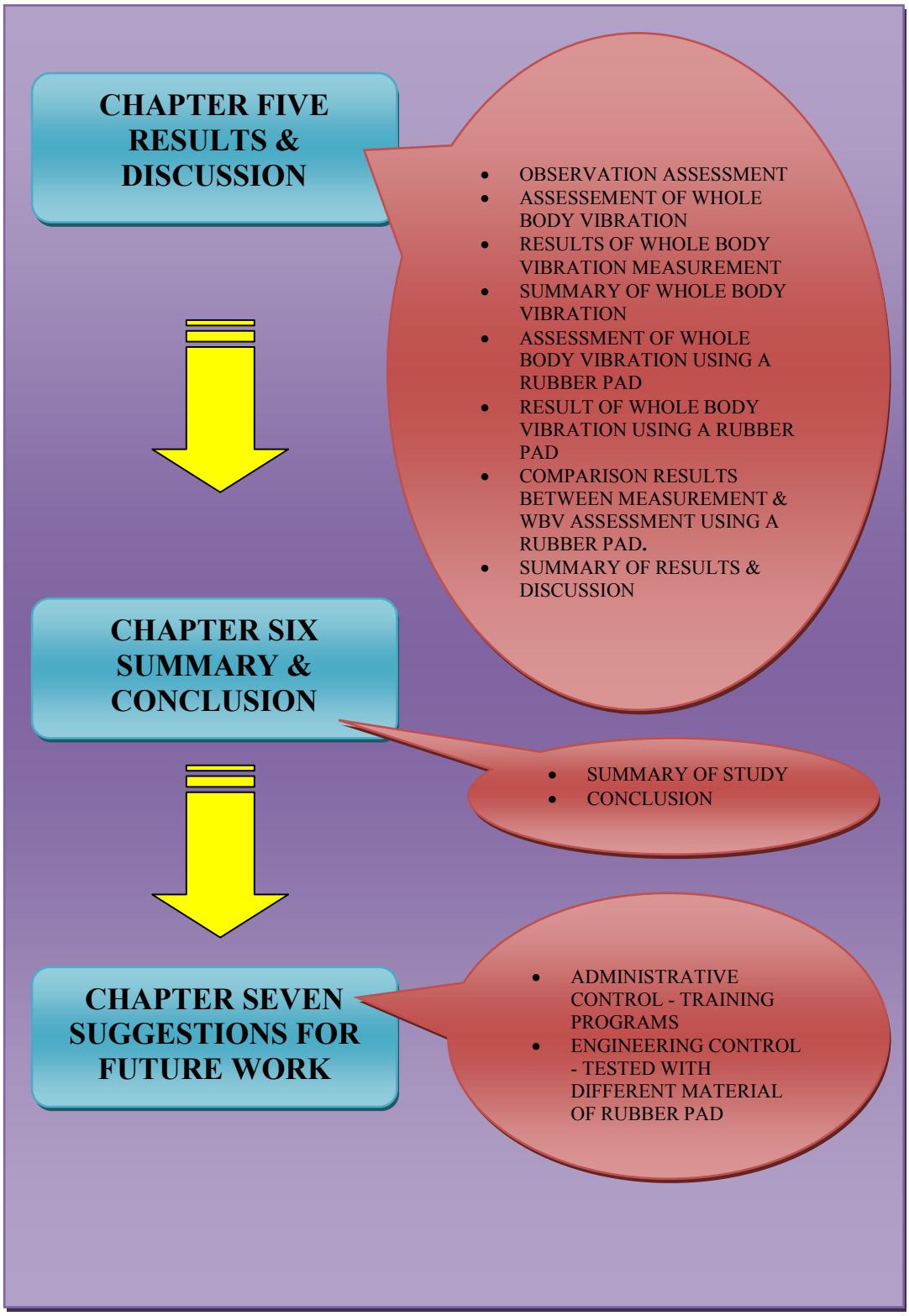


Figure 1.2: Structure of the project.