ABSTRAK

Projek ini telah dijalankan di PHN Industry Sdn.Bhd iaitu sebuah industri automotif yang terletak di Shah Alam. Projek akhir tahun ini memberi tumpuan untuk menghasilkan troli ergonomik berdasarkan data antropometri pekerja di syarikat PHN. Data daripada masalah yang dihadapi melalui kajian soal selidik dalam kalangan 14 pekerja di Receiving Area sahaja, kerana ia mempunyai jumlah faktor risiko ergonomik tertinggi. Menurut pemerhatian, temu bual dan soal selidik yang telah diedarkan, masalah utama adalah reka bentuk troli yang sedia ada di kilang, seolah-olah tidak sesuai dan memberi banyak masalah kepada pekerja terutama sakit belakang. Oleh itu, tujuan projek ini ialah bagi mereka bentuk semula sistem pengendalian bahan dengan menggunakan pendekatan ergonomik untuk mengurangkan risiko kesakitan sakit belakang. Perisian Tekscan digunakan untuk menilai daya taburan tekanan tangan. Ujian Tekscan telah dilakukan ke atas troli alternatif, troli sedia ada dan. keputusan yang diperolehi digunakan sebagai penanda aras untuk konsep troli untuk tujuan reka bentuk semula. Pemilihan reka bentuk konsep kemudiannya dimuktamadkan dengan menggunakan Penggunaan Fungsi Kualiti; Dewan Kualiti, Saringan dan kaedah pemarkahan. Reka bentuk akhir pemodelan 3D troli telah disediakan dengan menggunakan perisian SolidWork. Penilaian Anggota Badan Atas Pesat (RULA) telah digunakan untuk menganalisis postur pekerja pada troli sedia ada dan troli alternatif juga untuk troli reka bentuk semula yang akan dicadangkan di PHN. Berdasarkan analisis RULA itu, troli yang direka bentuk semula telah meningkatkan postur pekerja. Oleh itu, kajian ini menyimpulkan bahawa ciri-ciri ergonomik untuk troli yang direka bentuk semula menyumbang kepada postur badan yang selamat.

ABSTRACT

This project has been conducted in PHN Industry Sdn.Bhd such an automotive industry located at Shah Alam. This final year project is focusing to produce an ergonomic trolley based on anthropometry data of workers at PHN company. The data of the problems encountered through a questionnaire survey among 14 workers at Receiving Area only, since it has the highest number of ergonomic risk factor. According to the observation, interview and distributed questionnaire, the main problem is the existing trolley design in current factory, seems not suitable and giving many problems on musculoskeletal disorder of the workers especially back pain. Therefore, the aim of this project is redesign the material handling system by using ergonomic approaches to reduce back pain risk. The Tekscan software will be used for evaluating hand pressure distribution force. Tekscan test has been done on the existing and the alternatives trolley. The result obtained is used as a benchmark for the concept of trolley to be redesign. The selection of concept design is then finalized by using Quality Function Deployment (QFD); House of Quality (HOQ), Screening and Scoring method. The final 3D modelling design of the trolley was drawn by using SolidWork software. The Rapid Upper Limb Assessment (RULA) was applied to analyse the posture of workers on the existing and the alternative trolley also to the redesign trolley to be proposed at PHN. Based on the RULA analysis, the redesigned trolley has improved the posture of the workers. Hence, this study concludes that considering ergonomic features for the redesigned trolley contributed to safe body posture.

DEDICATION

Special dedication to my parents, lecturers, siblings and friends for giving me knowledge and moral support to complete the project and report.

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CATIA	-	Computer-Aided Three-Dimensional Interactive Application
HOQ	-	House of Quality
MSD	-	Musculoskeletal Disorder
PSM	-	Projek Sarjana Muda
RULA	-	Rapid Upper Limb Assessment
SPSS	-	Statistical Package for the Social Science
UTem	-	Univerisiti Teknikal Malaysia Melaka
V5	-	Version 5
WRULD	-	Work-Related Upper Limb Disorder
Eq.	-	Equation
3D	-	Three Dimensional

APPROVAL

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

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(Dr. Seri Rahayu Binti Kamat)

DECLARATION

I hereby, declared this report entitled “Redesign the Material System by Using Ergonomic Approach to Reduce Back Pain Risk” is the result of my own research except as cited in the references.

Signature :

Author’s Name : NUR AISYAH BINTI ABDUL HADI

Date :

CHAPTER 1
INTRODUCTION

Chapter 1 explains the project problem statements, objectives and scopes of reports. In general, it promoted the idea of the final project conducted and provides an initial overview of the entire contents of the project under tittle “Redesign the material handling system by using ergonomic approaches to reduce back pain risk”.

1.1 Background of Study

The good material handling is one of the features that contribute to the MSD problem especially in industry. Normally, there are several reasons for redesigning the material handling system such as improve work quality, workers performance, reduce cost and reduce pain suffered toward the workers. This study is about to redesign the material handling system by using ergonomic approaches to reduce back pain risk that have been conducted at PHN Industry Sdn. Bhd which are an automotive industry that specialized in metal-based and the largest dies manufacturer in Malaysia. The modification made based on workers complaint and the productivity of working area. Ergonomics applies information about human behavior, abilities and limitations and other characteristics to the design of tools, machines, tasks, jobs and environments for productive, safe, comfortable and effective human use (McCormick and Saunders 1993).

There are two type of ergonomic improvements which is engineering improvements and administrative improvements. Engineering improvements are improvement options that can be made by reorganizing, changing, redesigning, providing or replacing tools, equipment, workstations, packaging, parts, processes, products, or materials while administrative improvements are work practice or organization work improvement by observing the workers performance. For this project study, existing trolley at the Receiving Area is redesigned considering the load conditions and anthropometry of the workers. In general, the redesign activities will improves the standard and ability of the product design process (Li et al., 2006).

Generally, material handling is defined as simply handling of materials. Nevertheless, it is defined more comprehensively as using the correct method to provide the right amount of material, at the right place, sequence, time, position or condition, as well as cost (White and Apple, 1985). There are four types of material handling systems Automatic Guided Vehicles (AGV), conveyor system, robotic delivery system and push and pull system. This project study will be focusing on push and pull system. According to the researcher, people can usually exert higher push forces than pull forces. In some circumstances where pulling might be the only feasible means of movement, the situations should be avoided if possible. Even the highest force only take place at the start which is before movement begin. For example, when a worker push the trolley, the force is generate and transmit through a contact point with the equipment. To generate and apply force to the equipment, a worker must have sufficient friction on their feet, able to generate enough strength and apply their force to the equipment.

Back pain occurs due to cumulative or overexertion in lifting, pushing, pulling, carrying, bending and twisting during work. In this context, the problems related to non-ergonomic consideration of the existing trolley at the PHN Industry pose a back pain issue to the workers due to push and pull force movement while carrying the loads. RULA has been developed to provide a rapid of the load on the musculoskeletal system operators for position, muscle function and their powers impose. Back pain can

happened due to injury or diseases such as a slipped disc, sciatica, whiplash, frozen shoulder or ankylosing spondylitis. RULA meet their role as a method of screening a large some operator quickly, but the scoring system developed also an indicator of the level of loading experienced by individual body parts.

1.2 Problem Statement

The existing trolley design with current factory, PHN seems not suitable and giving many problems to the workers especially back pain risk. The main problem highlighted in this study is focused on material handling system during push and pull activity. The evidence have been collected from the interview, questionnaire and support with RULA analysis that will further describe in Chapter 3. In order to increase the workers productivity, the company should consider the aspect of ergonomic of the workers. When work with human, some consideration need to be taken such as rest allowance, safe environmental and material handling system for healthy issue as it may affect the worker productivity. Bad design of trolley, heavy load and repeatable push and pull activity will give bad effect to the back body if no immediate action are taken.

Ergonomists continuously strive to design work, tools or equipment to fit as many people as possible in the expected user population. In every situation, the rule that one size does not fit all becomes apparent. Since the anthropometry of every workers are different, some solution need to be recognize to change the rule to one size can fit all by knowing better about each ergonomic parameters to increase the quality of work.

1.3 Objectives

Basically, the main purpose of this project is to redesign the material handling system to reduce back pain risk that can gives comfort and happiness to workers when using the trolley. The objectives of this project are as follows:

1. To study of actual material handling system in Receiving Area
2. To evaluate hand pressure distribution force of existing product and other alternatives
3. To redesign for improve the material handling system at PHN company

1.4 Scope

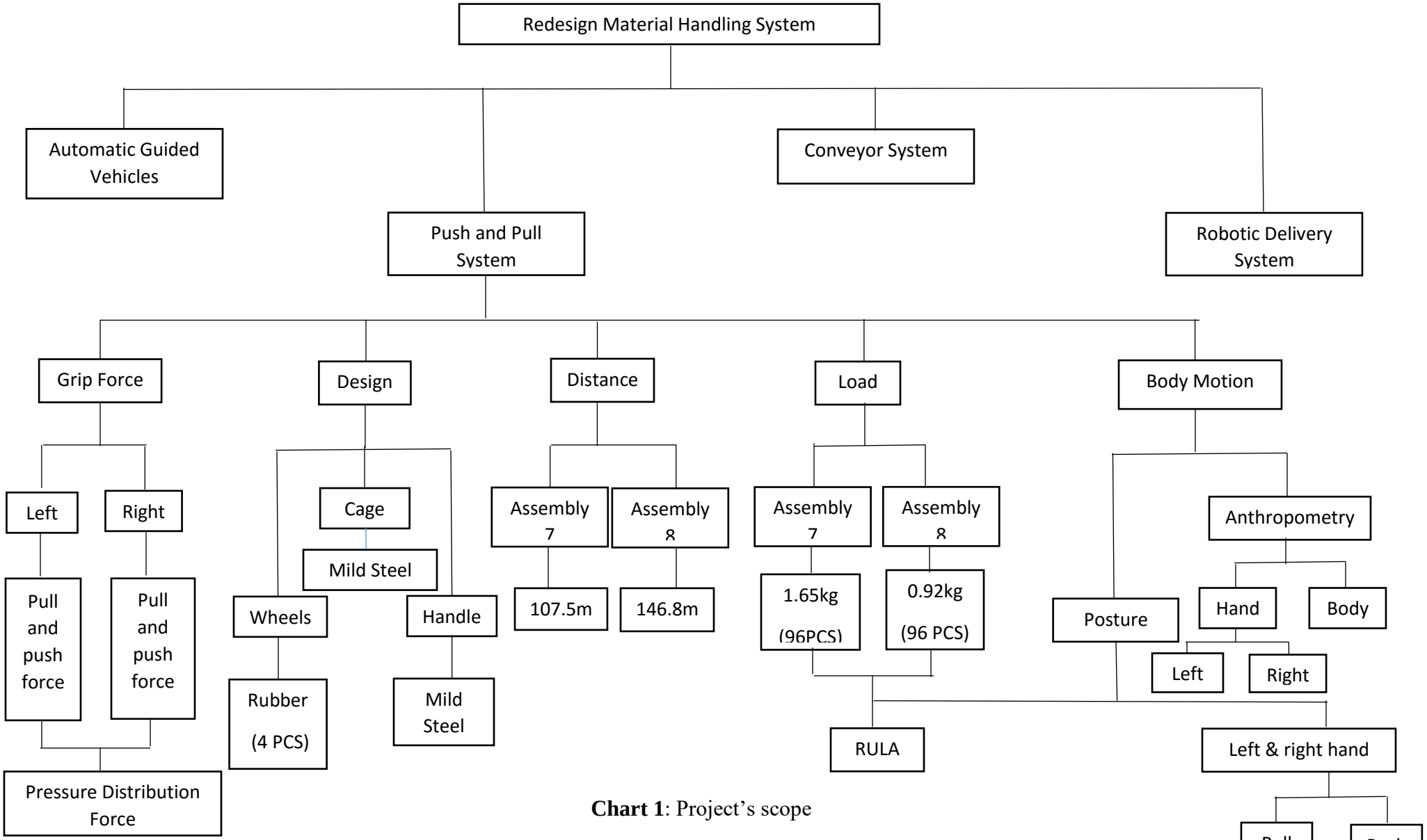

Chart 1: Project's scope

The focuses of this project is to make an improvements of trolley in terms of grip forces, designs, loads and also body motions. Thus, to obtain an ergonomic trolley, the existing trolley at PHN will be redesign in order to reduce the back pain risk. The analysis of comparison based on suitable grip force and design of trolley that required by the workers is conducted. Not only that, the suitable posture anthropometry, designed to be proposed and also carrying load will be analyzed using RULA analysis of CATIA V5.This project will concentrates on the characteristics of material handling system specification, conceptual design and the analysis conducted towards the purpose design which is focus only on ergonomic scope.

Chart 1 shows the limitation and boundaries to accomplish this project. This study only focused on push and pull system. The data gathered from both gender, female and male workers at PHN at Receiving Area in order to analyze the problems encountered by the workers.

CHAPTER 2
LITERATURE REVIEW

The chapter cover study of theory and relevant information related of this study. Researching the knowledge about redesigning material handling tools and some theoretical techniques which will be adopted to redesigning an ergonomic trolley at PHN. Through this study, the process of collecting and gathering the data are gained from various sources such as books, newspapers, magazines, journals, seminar papers, theses and also through interview with relevant parties.

2.1 Push and pull system

In most general terms, we could regard a handle as any part of an object that is held by any part of the hand (G.Kay, 2012). The adequacy of a handhold can be judged by much the same criteria as, say, a suitcase handle, a control knob or the handle of a hand tool (Pheasant and M.Haslegrave, 2006). Pushing and pulling actions are generally perform most easily at between shoulder height and elbow height or a little below, depending on the circumstances. According to biomechanical studies by (Ayoub and Daniel, 1973), the optimum level is 70-80% of shoulder height, which works out a little below elbow height or about 1000mm for men and 900mm for women.

2.2 Grip force

Grip strength is the greatest when the wrist is in its neutral position, reducing progressively as the wrist moves away from the neutral position in any direction such as flexion, extension,

radial deviation and ulnar deviation. Grip strength is least when the wrist is flexed. This is because when the wrist is flexed, the finger flexors which are the prime movers in the gripping action are shortened, and their capacity to generate tension is thus diminished. Standard anatomical terms that are used to describe the position and movement of the forearm, wrist and hand are illustrated in Figure 2.1. (Voorbij and Steenbekkers, 1998) found that the grip force of the dominant hand is stronger than by 6.5% than that of the non-dominant hand. If gloves are worn, the force that can be exerted is likely to be reduced due to poorer contact and increase likelihood of slipping at the handle-handle interface.

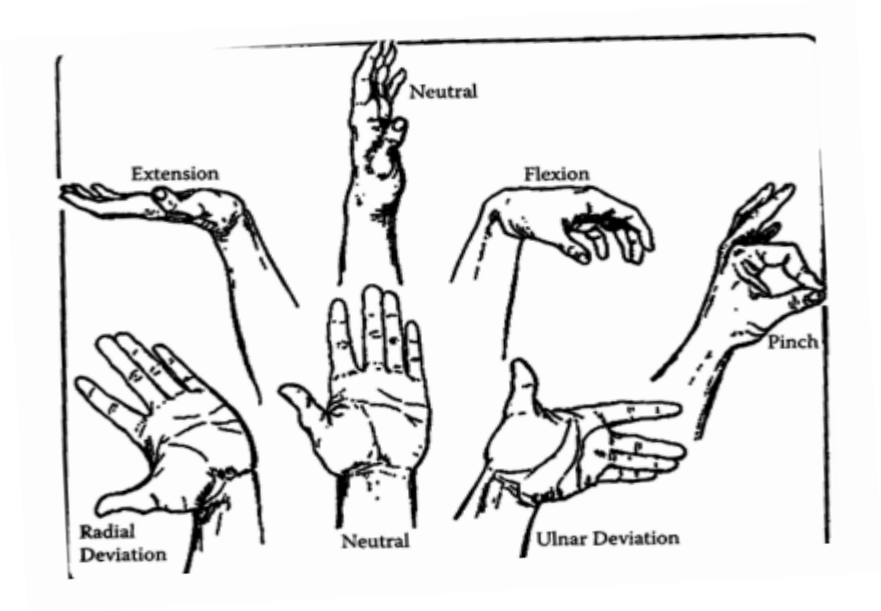

Figure 2.1: Hand and wrist postures. (From Putz-Anderson, V. (1988). *Cumulative Trauma Disorders*, London: Taylor & Francis, Fig.15, p.54. Reproduced with kind permission)

In a classic and widely quoted paper on the subject, (Napier, 1956) divided gripping actions (‘*prehension*’) into two main categories:

a) *Power grips*, in which the fingers and sometimes the thumb are used to clamp the object against the palm
b) *Precision grips*, in which the object is manipulated between the tips (pads or sides) of the fingers and thumb.

Although this classification will take a long way in understanding hand function, it is something of an oversimplification. In the basic of power grip shown in Figure 2.2 the thumb wraps around the back of fingers to provide extra stability and gripping force.