UNIVERSITI TEKNIKAL MALAYSIA MELAKA

ANALYSIS OF MATERIAL HANDLING FOR AUTOMOTIVE ASSEMBLY PROCESS

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

by

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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 of Bachelor of Manufacturing Engineering (Robotics & Automation) with Honors. The member of the supervisory committee is as follows:

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Supervisor's name : Dr. Fairul Azni bin Jafar

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DECLARATION

I hereby, declared this report entitled Analysis of Material Handling for Automotive Assembly Process is the results of my own research except as cited in references.

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ABSTRACT

This report presents the analysis of material handling for automotive assembly process. In order to improve automotive assembly process, the improvement of material handling need to be done as well as it will give positive effect to the productivity and efficiency. It also may improve company operational performance. Basically, the purpose of this project is to analyze theperformance of the new development of kit supply system that is used to supply materials from warehouse to assembly line. There are several problems are arisesduring the assembly process such as the parts are not properly place inside the old kit which all the parts are mix together that will lead to part rejection issues, scratches and part miss out, parts are stored at the line side of assembly line instead of in the warehouse, the operator walking steps to pick parts at the kit supply is over four steps, operator pick and bring the parts repeatedly and operator takes more time to select parts. These will affect the productivity and efficiency.Generally, the methodology comprise of three parts which is planning, design of model and analysis. In planning, the whole system include production line, kit supply system and parts need to be understand first to proceed with design of model. After doing a design of bin and cart model, the material supply, operator walking steps, part segregation and time picking parts method are ready to be analyzed. The result shows that the kit supply ratio over increase to 95%, bin separate by process location with one time pick from cart, reducing in operator walking steps and reducing in time for operator when picking parts. As a conclusion, the new kit supply system increases the productivity and efficiency of automotive assembly process.

ABSTRAK

Laporan ini membentangkan analisis pengendalian untuk proses pemasangan automotif. Dalam usaha untuk meningkatkan proses pemasangan automotif, peningkatan pengendalian bahan perlu dilakukan dan ia akan memberi kesan positif kepada produktiviti dan kecekapan. Iajugabolehmeningkatkanprestasioperasisyarikat. Pada asasnya, tujuan projek ini adalah untuk menganalisi sprestasi pembuatan sistem baru bekalan kit yang digunakan untuk membekalkan bahan-bahan dari gudang ketempat pemasangan.Terdapat beberapa masalah yang timbul semasa proses pemasangan seperti bahagian-bahagian yang tidak diletakkan dengan betul di dalam kit lama dimana semua bahagian bercampuran yang akan membawa kepada isu-isu bahagian hilang, calar , bahagian-bahagian yang disimpan di tempat pemasangan dan bukan dalam gudang, pengendali berjalan untuk mengambil bahagian di bekalan kit lebih dari empat langkah, operator memilih dan membawa bahagian-bahagian secara berulang kali dan pengendali mengambil lebih banyak masa untuk memilih bahagian. Ini akan memberi kesan kepada produktiviti dan kecekapan. Secara umumnya, metodologi terdiri daripada tiga bahagian iaitu merancang, merekabentuk model dan analisis. Dalam perancangan, keseluruhan sistem termasuk pengeluaran, sistem bekalan kit dan bahagian-bahagian perlu difahami untuk meneruskan dengan rekabentuk model. Selepas melakukan rekabentuk bin dan model kart, bekalan bahan, langkah pengendali, pengasingan bahagian dan masa mengambil barang sedia untuk dianalisa. Hasil kajian menunjukkan bahawa nisbah bekalan kit meningkat kepada 95%, bin berasingan mengikut lokasi proses dengan hanya satu kali masa memilih daripada kart, mengurangkan langkah berjalan pengendali dan mengurangkan waktu untuk pengendali mengambil bahagian. Kesimpulannya, sistem bekalan kit baru meningkatkan produktiviti dan kecekapan proses pemasangan automotif.

DEDICATION

To my beloved mother, father, brother and sister, and all my friends

To my supervisor, Dr. FairulAzni bin Jafar

All members of Bachelor of Manufacturing Engineering (BMFA)

All lecturers from BMFA department

Staff of Tan Chong Motor Assemblies SdnBhd, Serendah

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Assy	-	Assembly
Compl	-	Complete
Cm	-	Centimeter
Etc	-	et cetera
FR	-	Front
LH	-	Left hand
n.d	-	No date
Opt	-	Operator
RH	-	Right hand
RR	-	Rear
Supt	-	Supporting

CHAPTER 1
INTRODUCTION

In this chapter, the purpose of the project is described. It also discussed about the project background, motivation to do this project, problem statement, the objectives of the project, project scope and report structure.

1.1 Background

In recent years, there has been a tremendous growth of material handling technology and equipment types; robots, automated guided vehicles (AGV), electrified monorail systems (EMS), high-rise storage retrieval systems, computerized picking, systems and computer controlled conveyor systems. Material handling systems have been accepted as an integral part of today's manufacturing systems and are increasingly playing an important part in the productivity of the plant. Closely correlated to the development of this material handling equipment, a corresponding increase in deployment of integrated material handling environments with sophisticated planning and operational rules to achieve Just-In-Time and Lean manufacturing systems. Material handling projects are often costly ventures with many potential risks. There are many complex designs, operational and scheduling, issues that need to be addressed for successful implementation. Simulation technology can be used as a test-bed to better understand the system before its implementation. This understanding helps engineers design the best possible, lowest cost automation solution for their manufacturing, system. Simulation can be used as an affective analysis tool in the conceptual, detailed design, launching, and full operation phases of a project to avoid costly mistakes (Ulgen et al., 1994).

Material Handling Industry of America (MHIA) defines; material handling is the movement, storage, control, and protection of materials, goods and products throughout the process of manufacturing, distribution, consumption and disposal. The word material has very broad meaning covering all kinds of raw materials, work in process, subassemblies and finished assemblies. The primary objective of using material handling system is to ensure that the material in the right amount is safely delivered to the desired destination at the right time and at minimum cost. The material handling system is properly design not only to ensure the minimum cost and compatibility with other manufacturing equipment but also to meet safety concerns. The modern goals in material handling system design are to create a flexible system that can be used for a variety of products and processes and to integrate the currently designed material handling system in the overall material handling plan.

It is well understood that material handling improvement may have positive effects to the production more over in automotive assembly process. However, it is not only for production but so to give easiness to the employee to doing their job when assemble the materials. When the perception is positive, the benefits are possible. Evaluations are important when interventions into the work environment are implemented. The present works are specifically related to material handling management. By means of effective material handling management, the company's operational performance may improve (Chopra & Meindl, 2001; Rosenbloom, 2003)

There are 20 basic principles of material handling. Those are orientation principle, planning principle, system principle, unit load principle, space utilization principle, standardization principle, ergonomic principle, energy principle, ecology principle, mechanization principle, flexibility principle, simplification principle, gravity principle, safety principle, computerization principle, system flow principle, layout principle, cost principle, maintenance principle and obsolescence principle.

1.2 Motivation

In assembling Nissan car in Tan Chong Motor Assemblies factory in Serendah, the parts are taken from the warehouse to the assembly line. Parts are carried in cart also known as kit supply (kitting) which will be placed at the line side near the workstation. Therefore, this will cause high inventory at the line side. Operator will manual pull the cart and placed next to the car body for assembly process. When part supply process carried out, there are problems arise such as up station and down station, which will affect the productivity and efficiency.

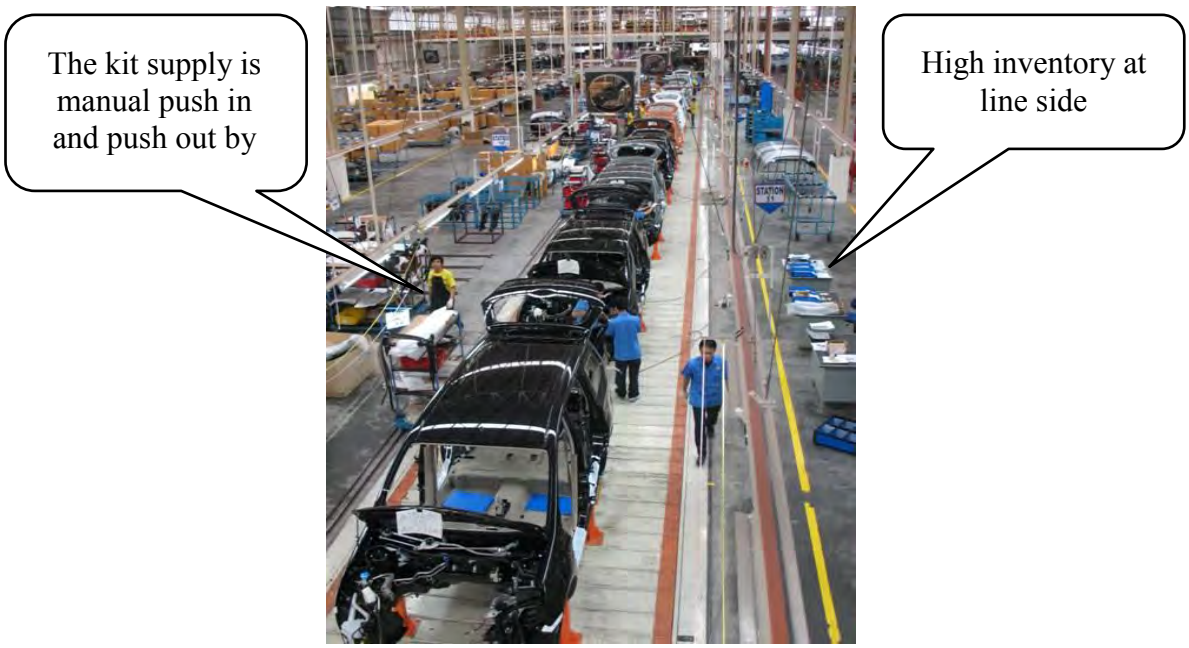

Figure 1.1: Layout of assembly line (Tan Chong Motor Assemblies Sdn Bhd, 2014).

1.3 Problem Statement

This study is conducted in the manufacturing sector of an automotive company. The manufacturing sector is responsible for almost all of the supply of assembly lines; including the vehicle components that go through a pre-assembly process before proceed to final product assembly. In this case, the material supply from warehouse to production line is by kit supply. All parts that will be assembled will be placed in the cart but there are still certain parts that placed at the line side in assembly line because most of the parts are big and cannot be place in current kit supply. Thus, part

is sent directly to the assembly line placed as temporary storage and lead to high inventory at assembly line. The inventory at line side should be reduced and perhaps increasing part inside the cart would be better solution because the operators just need to pick parts inside the kit supply instead of walk in long distance. Therefore, the time taken will longer and resulting in up station and down station problems.

The operator walking steps to pick parts at the kit supply is over four steps. In automotive sector, if the walking step of the operator is over 4 steps, there are considered as problem. Besides, parts are not properly placed inside kit supply as shown in Figure 1.2. This will lead to part rejection issues. Issues of scratches and part miss out also will occur because the operator pick and bring the parts repeatedly. All these problems will affect on the productivity and efficiency of the automotive assembly process.

Figure 1.2: The current condition of kit supply (Tan Chong Motor Assemblies Sdn Bhd, 2014).

1.4 Objective

The objectives of this project are as follows:

a) To design an efficient kit supply to supply material from warehouse to production line for assembly process.
b) To analyze the performance of the new development of using kit supply on the production line.

1.5 Scope

The scopes of this project are listed below:

a) Analysis is performed only on one model of car which is L02B (Nissan Almera).
b) The assembly processes occur at trim line, loop 1 which consists of certain work of assembly.
c) Loop 1 consist of four stations which is each station have an operator that will do different work.
d) The operator will pick parts in same kit supply that is provided from station 1 to station 4 which is move by the conveyor.
e) The movement of kit supply from warehouse to the assembly line will not consider in this project.

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1.6 Report structure

The project title, analysis of material handling system for automotive assembly process is a combination of five chapters that contains the Introduction, Literature Review, Methodology, Results and Outcome, and discussion and Conclusion.

In chapter 1, it is basically about introduction of the project including the project background, problem statement, objective, scope and project outline. In chapter 2, it describe about the literature review for the analysis of material handling system for automotive assembly process. It also contains about the components of this project. While chapter 3, discuss on the methodology of this project including the project flow chart and testing. For chapter 4 and 5, it usually discuss about the result after tests have been done. The conclusion will be made to ensure that the objectives of this project can be achieved.

CHAPTER 2
LITERATURE REVIEW

This chapter will provide the review from previous research that is related to this final year project. There are previous researches about kitting system for supply materials to assembly line. The advantages and disadvantages of the kitting theory will be explained in this chapter. Other than that, kit preparation and supplying the components/parts to assembly line will be discussed further in this chapter.

2.1 Material supply

Material supply mainly concerned about what kind of principle to be used for supplying the material or parts to workstation or assembly line. There are three principles exist in one system and for different kind of parts complement each other. There are kit/bin supply, lot supply and sequential (bulky) supply. There are four principle of material feeding was identified namely continuous supply, batch supply, kitting and sequential supply (Johansson, 1991).

2.1.1 Lot/batch supply

Lot supply is when the parts is supplied in the form or quantity prescribed. For example, in Tan Chong Motor Sdn Bhd one lot is equivalent to 12 parts. Thus, one lot will be supplied from the warehouse to the assembly line when the previous lot has been exhausted. Therefore, this will create line side storage in assembly line. Johansson (1991) describes lot supply when the materials supplied for a number or specific assembly objects. The material stored at the line side of workstation and the

remaining materials is stored at the warehouse, unless it is to be use for the next batch. This work is eliminated in the latter case, but instead the parts need to be counting which requires technical and administrative system.

2.1.2 Sequential supply

Sequential supply is considered as a big part. Part are supplied in sequence together with a car body that will be move along the conveyor to production line after finished from paint shop. Therefore, the operator only just takes part that has been arranged. Johansson (1991) states that the explosion of product variants during the last decade in some cases has made continuous supply impossible due to capital cost and lack of space at the assembly station. One way to solve this problem is to use sequential supply. It means that part number needed for a specific number of assembly objects are displayed at the assembly stations, sort by object.

2.1.3 Kit/bin supply

Kit supply is part supplied from the warehouse to the assembly line by cart. The cart is consists of all the parts that will be assembled on the car body. Parts will be placed into the cart by the picker in the warehouse. Johansson (1991) describes kitting means that the assembly is supplied with kits of components. The parts are sorted according to the assembly object; this differs with lot supply, where part number sort parts.

2.2 Kitting theory

In manufacturing system, the practice of delivering components and sub-assemblies to the production line in specific quantities that are placed together in specific containers are known as kitting. Cart with parts supplied in the assembly line will be located in close proximity to the car body so that operators can easily to take part respectively. The cart will move along with the body of the car on the conveyor. Each station has a different operator and work, so each station has its own part. The alternative to kitting is to bring all parts to racks on the line side, for assemblers to pick when they are needed.

2.3 Kitting versus line side supply

Kitting and line-side supply are two major parts supply strategies that can be used in combination, but usually are not. Some plants are design around kitting all parts prior to assembly; others, around bringing them individually to line-side stores at assembly stations. In reality, the better strategy is to combine these approaches on the same line.

Kitting is common, but usually poorly done. In most factories, the concept of kitting consist of throwing together all the parts needed to make a lot of a product into a tote, in their original packages, sometimes weeks in advance of building the product. By doing this, parts are commit to a particular use before and have to break kits if, as commonly happens, another use takes priority in the meantime. In short, nothing good and plenty of mishaps can happen to these kits from the time they are picked to the time they are used. The throwing-together-in-a-tote approach also makes the completeness of a kit difficult to access. The proper way to kit is:

- For a single unit of product
- Just before assembly
- With parts unpacked
- Onto a structure pallet with an assigned location of every part

Figure 2.2: An example of kit pallet (Tan Chong Motor Assemblies Sdn Bhd, 2014)

The alternative to kitting is to bring all parts in one cart that is supply from warehouse to the line side of the production line, for assemblers pick when they are needed. While line side storage uses more space on the line than kitting, this method has the advantage of requiring less handling and being better able to cope with the presence of defects. If assemblers pick a defective part on the line side, they can place it in the reject bin and pick a new one, which this cannot do with kits. A reasonable strategy in a mixed-flow line is line side supply for all common parts, and for as many product-specific parts as can be fit on the shelves, and kitting for remaining product-specific parts.