

MAINTENANCE SYSTEM ANALYSIS OF VEHICLES AND AIR-CONDITIONERS  
AT UNIVERSITI MALAYSIA PAHANG (UMP)

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**SUPERVISOR'S DECLARATION**

We hereby declare that we have checked this project and in our opinion this project is satisfactory in terms of scope and quality for the award of the degree of Bachelor of Mechanical Engineering.

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**STUDENT'S DECLARATION**

I hereby declare that the work in this thesis is my own except for quotations and summaries which have been duly acknowledged. The thesis has not been accepted for any degree and is not concurrently submitted for award of other degree.

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Dedicated to my beloved:

Father,

Mother,

Sister,

Brothers,

Lectures and

Friends.

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## ABSTRACT

This project deals with the maintenance system at JPPH for the analysis of the vehicles and air-conditioners maintenance system in Universiti Malaysia Pahang (UMP). The objective of this project is to ensure that vehicles and air-conditioners maintenance exercises are recorded in a systematic way and to ensure that vehicles and air-conditioners maintenance cost is in control. The scopes of this project are review breakdown history of vehicles and air-conditioners, review the maintenance cost of the vehicles and air-conditioners, and propose improvement of maintenance management. The improper trend is observed in 6-Month Periodic RM/km Ratio for Bas Mini and Van Mercedes. The analysis shows that the cost of breakdown for both vehicles is not justified. Wira has the highest Average RM/km ratio among the cars. Therefore, the usage of Wira should be minimized in order to reduce its maintenance cost or another alternative is scrapped this vehicle. Investigation for the root cause of breakdown whether due to low quality product or human mishandling is never been carried out. Current maintenance exercises of air-conditioner shows that the cost for the maintenance operation are not recorded, location for the air-conditioners units are not specific and many tag number are not in place. The breakdown history of air-conditioner has never been prepared and the Work Order is not utilized properly. Repeated type of breakdown also occurred in the sample analysis of Fakulti Kejuruteraan Mekanikal (FKM).

## ABSTRAK

Projek ini melibatkan sistem penyelenggaraan di Jabatan Pembangunan dan Pengurusan Harta (JPPH) untuk analisis sistem penyelenggaraan kenderaan dan alat penghawa dingin dalam UMP. Objektif projek ini adalah untuk memastikan kerja-kerja penyelenggaraan direkod dengan cara yang sistematik dan untuk memastikan kos penyelenggaraan untuk kenderaan dan alat penghawa dingin berada dalam kawalan. Skop projek ini adalah menganalisa sejarah kerosakan untuk kenderaan dan alat penghawa dingin, menganalisa kos penyelenggaraan untuk kenderaan dan alat penghawa dingin serta mencadangkan pembaikan untuk pengurusan penyelenggaraan. Corak aliran yang tidak normal dapat dilihat untuk analisis Nisbah RM/km 6-bulan berkala untuk Bas Mini, Van Toyota dan Van Mercedes. Analisis ini menunjukkan kos penyelenggaraan untuk kedua-dua kenderaan adalah tidak munasabah. Untuk analisis Purata Nisbah RM/km, Wira adalah yang tertinggi diantara kenderaan lain. Oleh itu, penggunaan Wira hendaklah diminimakan untuk mengurangkan kos penyelenggaraan atau cara lainnya kenderaan ini dihapuskan. Kajian tentang punca berlakunya kerosakan samada kerana kualiti produk yang rendah atau ketidaksempurnaan pengawalan oleh manusia tidak pernah dianalisis. Kerja penyelenggaraan masa kini untuk alat penghawa dingin menunjukkan kos operasi penyelenggaraan tidak direkod, lokasi untuk setiap unit alat penghawa dingin tidak spesifik, dan kebanyakan label tiada. Sejarah kerosakan penyelenggaraan tidak pernah disediakan dan Work Order tidak pernah digunakan sepenuhnya. Kerosakan berulang juga pernah berlaku dalam sample analisis FKM.

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## **CHAPTER 1**

### **INTRODUCTION**

#### **1.1 PROJECT BACKGROUND**

Maintenance is the recurring day-to-day, periodic, or scheduled work required to preserve or restore facilities, systems, and equipment to a given condition. In the early stages of industrial development, maintenance practices were simple, primarily of the housekeeping and breakdown types. However, as the complexity of facilities, equipment and systems increased, so did the problems and expenses involved in maintenance operations. It became increasingly obvious that improvement of maintenance management practices and procedures was essential to achieve efficiency and effectiveness of the maintenance operations. [1]

Focuses on the project that was held at mechanical unit of the Department of Development & Asset Management in University Malaysia Pahang (UMP), the analysis for vehicles and air-conditioner maintenance system will be studied. The function of maintenance department includes:

- i. Planning and repairing equipment/facilities to acceptable standards
- ii. Preparing realistic budgets that detail maintenance personnel and material needs
- iii. Managing inventory to ensure that parts or materials necessary to conduct maintenance tasks are readily available
- iv. Keeping records on equipment and services

A good maintenance management system does not have to be complex. In fact, the greatest and most successful system is one that is simple, practical and gives the preferred results. [1]

## **1.2 PROBLEM STATEMENT**

Breakdown history is one of the important data that include the history of corrective and preventive maintenance for each of the equipment. Maintenance analysis could not be done if the breakdown history is not available. The history also could indicate whether the equipment is worth to be kept.

Cost analysis is an extremely important part of controlled maintenance management. The analysis includes the previous, present and future cost. Cost is very important and necessary for developing the maintenance budget for the next fiscal year. Expenditure cost should be analyzed to detect any improper trend.

## **1.3 OBJECTIVES OF PROJECT**

The objectives of the projects are:

- i. To ensure that vehicles and air-conditioners maintenance exercises are recorded in a systematic way.
- ii. To ensure that vehicles and air-conditioners maintenance cost is in control.



#### **1.4 SCOPE OF PROJECT**

The scopes of this project are:

- i. Review breakdown history of vehicles and air-conditioners.
- ii. Review the maintenance cost of the vehicles and air-conditioners.
- iii. Propose improvement of maintenance management.

## **CHAPTER 2**

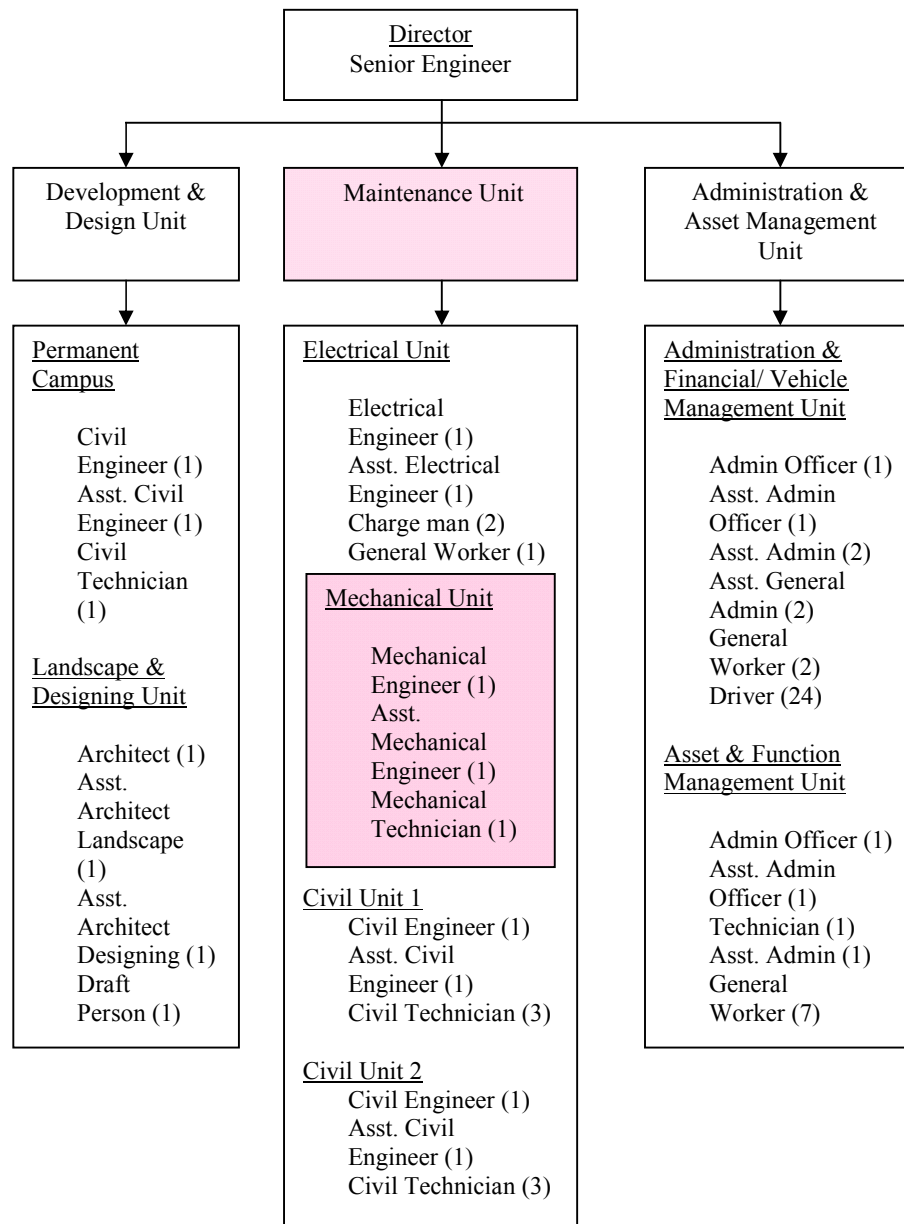
### **LITERATURE REVIEW**

#### **2.1 INTRODUCTION**

Figure 2.1 show the organization charts of Department of Development & Asset Management in University of Malaysia Pahang (UMP) consist of three departments, which are Development & Design Unit, Maintenance Unit, and Administrator & Asset Management Unit that have 67 of personnel. The project focuses on maintenance department in mechanical unit, just have three workers. There are consists of mechanical engineer, assistant mechanical engineer, and mechanical technician.

The maintenance department of a company is the in-house provider of essential services. It is essential that the maintenance department be always involved in design planning to assure that equipments are not located in a position where it cannot be maintain. The maintenance department has overall responsibility for the administration, supervision, and operations and for performing maintenance and repair of facilities, systems, and equipment. [1]

The effective implementation of the controlled maintenance management system and achievement of the full value of the system requires the establishment of a proper organizational pattern. [1]



**Figure 2.1:** Organization Chart

## 2.2 MAINTENANCE SYSTEM

Maintenance, including tests, measurements, adjustments, and parts replacement, performed specifically to prevent faults from occurring. Nowadays, maintenance of engineering equipment in the field has been a challenge. Although impressive progress has been made in maintaining equipment in the field in an effective manner, maintenance of equipment is still a challenge due to factors such as size, cost, complexity, and competition. Today's maintenance practices are market driven, in particular for the manufacturing and process industry, service suppliers, and so on. An event may present an immediate environmental, performance, or safety implication. Thus, there is a definite need for effective asset management and maintenance practices that will positively influence critical success factors such as safety, product quality, and speed of innovation, price, profitability, and reliability delivery. [13]

The maintenance and control of maintenance activities are equally important to perform maintenance. Maintenance management may be described as the function of providing policy guidance for maintenance activities, in addition to exercising technical and management control of maintenance programs. Generally, as the size of the maintenance activity and group increases, the need for better management and control become essential. [13]

Controlled maintenance management is an organized, systematic, and controlled approach to maintenance and its management through the effective application of the following basic principles such is organization, inventory, continuous inspection, planning, scheduling and management maintenance analysis. The system consist of organizing, planning, supervision, coordination and control of the functions necessary to ensure that a department can continually perform its designed function in an economical manner within budgeted limits. The system ensures that the maintenance will obtain the most efficient operation of equipment,

and materials in achieving this goal. The continuing objective of the control effort is to increase productivity, achieve savings, and ensure that the designated level or standard of maintenance is achieved. [1]

A detailed and completed inventory of all buildings, facilities, utilities, systems and equipment is used to determine the scope of the maintenance effort required, the condition of the facilities and equipment and the types. The completed inventory provides the necessary data to establish the facility and equipment files. [1]

The history file in maintenance management system in UMP such as report repairing, corrective and preventive maintenance in hardcopy will be collected in one file to store it.

All of the operation of maintenance in UMP such as organize, manage, locate, schedule, and maintain the maintenance based on two of the software. Fleet Management System is software for organize all of the operation maintenance of vehicles. FMS software includes both of the preventive and corrective maintenance system. While the other one is Computerized Maintenance Management System (CMMS) is software for the others operation of maintenance management. CMMS just only use in corrective maintenance system for now and the preventive maintenance system will be use this software soon. This software started use in January 2008, so just the latest record had in this system.

### **2.3 SPLIT UNIT AIR-CONDITIONER**

Split Unit air conditioners as shown in figure 2.2 have separate evaporator and condenser units. The main air conditioning unit is positioned in the room where cooling is required while the condenser, which is connected to the room unit with a flexible refrigerant pipe, is placed outside through either a window or door to expel the warm air. [5]

Split Unit air conditioners are powered by simply plugging into a standard 13-amp power supply. The type of air-conditioner commonly used in UMP is the split unit air-conditioner. An amount of 861 unit of split unit air-conditioner that is still

functioning. The common brand were used is York and others were National and Acson. The maintenance process for this equipment shows in figure 2.9 and figure 2.10.



**Figure2.2:** Split Unit Air-conditioner

## 2.4 MAINTENANCE MANAGEMENT SYSTEM IN UMP

The department of maintenance management system in UMP uses the software to organize all of the maintenance. The software maintenance is the modification of a software product after delivery to correct faults, to improve performance or other attributes. There is the two of the software that use in maintenance management. Fleet Management System (FMS) is use in the vehicle maintenance management, while the other one is Computerized Maintenance Management System (CMMS) use in air-conditioner maintenance management. The software system starts the operation in January 2008 until now. Before the software is in practice, manual system was used for maintenance management.

Generally, there are two types of equipments that need to be maintained namely:

- i. Vehicle – Car, Bus, Van, Motorcycle, 4-wheel drive and Lorry
- ii. Non-vehicle – Air-conditioner

Types of maintenances involved are:

i. Corrective Maintenance

-Corrective maintenance, sometimes called “repair” is conducted to get equipment that breaks down to works again. Corrective maintenance defined as the remedial action carried out due to failure or deficiencies discovered during preventive maintenance, to repair equipment to its operational state. Usually, corrective maintenance is an unscheduled maintenance action, composed of unpredictable maintenance needs that cannot be preplanned or programmed on the basis of occurrence at a particular time. The action requires urgent attention that needs to be added or substituted for previously scheduled work items. [13]

ii. Preventive Maintenance

- Preventive maintenance (PM) is an important component of maintenance activity. PM described as the care and servicing by personnel involved with maintenance to keep equipments in satisfactory operational state by providing for systematic inspection, detection, and correction of incipient failures either prior to their occurrence or prior to their development into major failure.

Objectives of PM are to reduce critical equipment breakdowns, allow better planning and scheduling of needed maintenance work, and promote health and safety of maintenance personnel. [13]

#### **2.4.1 Fleet Management System (FMS)**

Fleet Management System is one of the software that use in UMP. Only the vehicles use the fleet management software in maintenance management system. Fleet management software used to supervise, manage, locate, schedule, and maintain vehicle fleets. Asset management involves tasks such as the cost analysis and valuation, and calculating depreciation. [3]

With fleet management software, planning and forecasting activities may include line maintenance planning, work packaging, estimating, capacity planning, and supply chain management. Work packaging allows users of fleet management software to combine different maintenance requirements, sometimes on different assets, to complete work in the most efficient way. Estimating is an important module for users of fleet management software who have budgetary, accounting, or financial oversight activities. For organizations with large fleets of vehicles, capacity planning can be critical. [3]

#### **2.4.2 Computerized Maintenance Management System (CMMS)**

Computerized Maintenance Management Systems (CMMS) are designed to help maintenance organizations reduce maintenance costs, improve asset performance, and increase maintenance productivity. Today's CMMS software systems also include inventory control, purchasing, receiving, invoicing (receivables and payables), budget control, calibration management, document control, etc. CMMS systems are very helpful as long as they are implemented in the way for you to receive the data you need. When selecting CMMS software, you must define a list of features that you need now and a list that would be nice to have. The success stories of implementing a CMMS always include user requirements. The users' requirements are a detailed list of how the users from all affected departments will use the CMMS, and what features they need to perform their job.

Computerized maintenance management system (CMMS) used to manage maintenance operations on capital equipment and other assets and properties. CMMS software helps maintenance personnel and departmental managers make better decisions for the allocation, maintenance, scheduling, and disposal of equipment and properties. [3]

Computerized maintenance management software includes features such as Work Order generation, event logs, scheduling of preventive maintenance checks and services. CMMS software also allows users to plan equipment maintenance activities