MAINTENANCE MANAGEMENT PRACTICES AT SABAH STATE LIBRARY HEADQUARTERS

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A Final Year Project submitted in fulfillment of the requirements
for the degree of
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DECLARATION

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I hereby declare that this final year project is the result of my own work, except for quotations and summaries which have been duly acknowledged.

Signature : Date :

MAINTENANCE MANAGEMENT PRACTICES AT SABAH STATE LIBRARY HEADQUARTERS

ABSTRACT

The deterioration of assets or facilities far beyond their expected life are because lack of maintenance being carried out after completed built up or during the period in which the assets or facilities operating. Therefore, this study is aim to explore the effectiveness of maintenance management practices in the building. All the process of this study is carried out at Sabah State Library (SSL) Headquarters. The research instrument is applied in this study that is the questionnaire form to collect data from the respondents. A total of 83 respondents involved in this questionnaire, of which 53 respondents were from the employees of SSL Headquarters while another 30 respondents were the visitors of SSL Headquarters. Besides, semi-structured interview also has been adopted in this study with two officers of SSL Headquarters. In doing so, it is to gain an in-depth understanding into maintenance management practices at SSL Headquarters. The findings shows a very encouraging results on the effectiveness of maintenance management practices at SSL Headquarters. Due to there are only minor defect factors existed instead of major defect factors. But, there are still a room of improvement to avoid major defect factors occur. As a result, recommendations are provided for continuous improvement. In short, it can be concluded that the research objectives have been achieved in this study.

Keywords: Deterioration, Assets, Maintenance Management, Sabah State Library (SSL) Headquarters, Defect.

AMALAN PENGURUSAN PENYELENGGARAAN DI IBU PEJABAT PERPUSTAKAAN NEGEGI SABAH

ABSTRAK

Kemerosotan aset atau kemudahan yang jauh melebihi jangkaan hidup mereka adalah kerana kekurangan penyelenggaraan dilakukan setelah siap dibina atau semasa dalam tempoh di mana aset atau kemudahan beroperasi. Oleh yang demikian, kajian ini bertujuan untuk meneroka keberkesanan amalan pengurusan penyelenggaraan di bangunan. Semua proses kajian ini dijalankan di Ibu Pejabat Perpustakaan Negeri Sabah (SSL). Instrumen kajian digunakan dalam kajian ini iaitu borang soal selidik untuk mengumpulkan data daripada responden. Sebanyak 83 responden terlibat dalam soal selidik ini iaitu 53 responden adalah dari pekerja Ibu Pejabat SSL sementara 30 responden lagi adalah pelawat Ibu Pejabat SSL. Selain itu, temu bual separa berstruktur juga telah digunakan dalam kajian ini dengan dua pegawai Ibu Pejabat SSL. Dengan berbuat demikian, ini adalah untuk mendapatkan pemahaman mendalam mengenai amalan pengurusan penyelenggaraan di Ibu Pejabat SSL. Hasil kajian menunjukkan hasil yang sangat memberangsangkan terhadap keberkesanan amalan pengurusan penyelenggaraan di Ibu Pejabat SSL. Ini adalah kerana hanya ada faktor kecacatan kecil dan bukannya faktor kecacatan utama. Akan tetapi, masih ada ruang penambahbaikan agar dapat mengelakkan faktor kecacatan utama berlaku. Oleh itu, cadangan diberikan untuk penambahbaikan yang berterusan. Secara ringkasnya, ia dapat disimpulkan bahawa objektif kajian telah dicapai dalam kajian ini.

Kata Kunci: Kemerosotan, Aset, Pengurusan Penyelenggaraan, Ibu Pejabat Perpustakaan Sabah (SSL), Kecacatan

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THANK YOU

Siaw Siew Kong
26 April, 2021

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LIST OF ABBREVIATIONS

APA	American Psychological Association
AHU	Air Handling Unit
CBM	Condition-Based Monitoring
CCMS	Computerised Maintenance Management System
CCTV	Closed-Circuit Television
CI	Continuous Improvement
CM	Corrective Maintenance
FMEA	Failure Modes and Effects Analysis
KK	Kota Kinabalu
M&E	Mechanical and Electrical
ROI	Return Of Investment
SSL	Sabah State Library
PWD	Public Works Department
RCM	Reliability-Centred Maintenance
USC	University of Southern Carlifornia

CHAPTER 1

INTRODUCTION

1.1 Introduction

Assets, whether they are building, plant, machinery, facilities, equipment and so on are built to meet human activities and nature requirements. Every assets are built for a specific purpose and function. For an example, condominium is built for living purpose, water treatment plant is used to ameliorate the quality of water for a particular end-use, Air Handling Unit (AHU) is a equipment used to re-condition air and supply it to the building, and such. In order to keep the purpose and function of these constructed assets, they must be well maintained constantly. The deterioration of assets far beyond their expected life are because lack of maintenance being carried out after completed built up or during the period in which the assets operating. All these assets require periodic maintenance to maintain their function properly. This statement supported by Rahmat et al.(2016), some assets may have a short lifespan if not maintained properly and a very long life if properly and regularly maintained. Besides, Mat and Baharum (2015) also stated that this could happen over a short period of time, sometimes immediately after completed built up, or it could happen over a long period of time. While Mat and Baharum (2015) stated that proper maintenance limits the level of this deterioration, lack or poor maintenance aggravates the rate of physical wear and tear, functional incapacitation and inability to command value.

Therefore, any assets should be maintained on a regular basis to ensure optimum performance of the services and to avoid major failure which may be costly to repair. Since maintenance is identified as an approach to combat the inevitable degradation of assets over their operational lifetime and keep them in a working order (Alrabghi & Tiwari, 2015). For this reason, maintenance management plays the pivotal role in deciding the success or failure of the assets. In the views of Karia et al. (2014), maintenance management is essentially a preventive management philosophy and it should be considered as a business function which

provides opportunities to retain quality, life and value of assets and improve cost, risk and productivity concern in organizations. Also, the effectiveness of maintenance management can provide positive effects on organization by reducing the need for further capital investment as well as to enable business services to function at an optimum level.

1.2 Problem Statement

Effective maintenance on assets require highly professional expertise personnel. This expert should be able to plan an effective maintenance strategy or action to prevent the assets failure during operation period or repair the component of assets in a timely manner before they fail to run at a critical time. Also, there are several things that will have a significant impact on the assets without well maintained like increasing repair costs, adding assets downtime, raising the risk of safety and health, and accelerating the lifespan of assets. Therefore, effective maintenance management can be said that is an important strategy or action to backing the primary business function of an organization. Alsyouf (2009) pointed out at least 14% of the potential improvements in Return Of Investment (ROI) are directly related to the contribution of maintenance functions to lost profit, which is due to unplanned stoppages and bad quality caused by maintenance-related problems.

However, lack of maintenance on assets, most of the assets can be run out their expected life than intended purpose. How much the assets can last and function as expected life depends greatly on how well the maintenance to be managed. Also, the issue of effective maintenance management was not paid much attention in service industry (Karia et al., 2014) especially in public sector areas. There are still many public sector do not aware the importance of maintenance on assets. Due to Sabah State Library (SSL) Headquarters is considered as the service industry sector and also known as public space that will definitely attract many visitors come to enjoy the facilities provided. Thus, the facilities provided by SSL Headquarters will greatly influence on interests of public. Even though SSL Headquarters only has 17 years old from the time the building was started to be used by June 2004 year. But, effective maintenance practices should be applied to the assets when they are beginning to operate so as to find out the defects earlier. For this reason, this research is conducted to study the effectiveness of current maintenance management practices at SSL Headquarters. To identify whether the SSL Headquarters neglect the importance of maintenance on assets or facilities of SSL Headquarters.

1.3 Research Objectives

This research is aimed to study current maintenance management practices, its issues and effectiveness at SSL Headquarters. In short, the objectives of this research are described as following:-

a) To study the effectiveness of current maintenance management practices at SSL Headquarters.
b) To identify the defects of the assets or facilities at SSL Headquarters.
c) To propose recommendations for continuous improvement.

1.4 Scope of Research

This research primary focus discusses the maintenance management practices at SSL Headquarters. The primary scope of this research will be focused on the effectiveness of current maintenance management practices, the causes and effects for inadequate maintenance management, and recommendations that can be used to improve the maintenance management practices at the SSL Headquarters. The information and data are collected through questionnaires method with the employees and the visitors, and interview conducted with the head of maintenance department and two employee technicians from the SSL Headquarters. Besides, a literature review on the maintenance of assets or facilities are also conducted to obtain additional information.

1.5 Significance of the Research

The importance of this research is can be a reference in the future as the need for maintenance management practice has gradually become very important factor on the constructed assets or facilities. It is because this research aims to assess the effectiveness of maintenance management practices as well as to identify critical success factors for maintenance management to ensure the success of facilities or assets. In addition, this research aids in suggesting improvement recommendations for assets to avoid greater loss of profits. Finally, the findings from the research can assist the maintenance department to prevent or minimize the effects of malfunctions in the future. A preventive maintenance

procedure can be implemented in accordance to the findings of this research to enhance the quality of service and safety for the assets or facilities of building.

1.6 Structure of the Thesis

This thesis is categorized into five chapters and the content of each chapter is structured as follows:-

Chapter 1 Introduction: This chapter contains brief context of the research introduction, problem statement, objectives of the research, scope of research and the significance of the research.

Chapter 2 Literature review: This chapter reviews literature on the maintenance activities. The main topics in this chapter are divided into introduction, overview on the background of case study, definition of maintenance, evolution of maintenance, the importance of maintenance management, maintenance policy, types of maintenance, and maintenance insourcing and maintenance outsourcing. Meanwhile, the subtopics are divided into objectives of maintenance policy, criteria for maintenance insourcing and maintenance outsourcing, as well as the advantages and disadvantages of maintenance insourcing and maintenance outsourcing.

Chapter 3 Research methodology: This chapter presents details the methodology utilized in this research. It mainly focus on how to create research design and development to obtain data via questionnaires method as well as its procedures to use for. Also, the data analysis is described clearly which method is used to get the answer.

Chapter 4 Result and discussion: This chapter presents the results obtained from the research. It includes data analysis and findings of the research as well as the result of semi-structured interview at SSL Headquarters.

Chapter 5 Conclusion: This chapter presents the conclusion of the research and summary of the answer for research objectives.

1.7 Definitions of Key Terms

In order to avoid ambiguity and misunderstanding of the key terms, it is require to provide definition in this research. This is important to ensure that it gives meaning and understanding in the proper context for the research. The key terms involved in this research are explained as follows:-

1.9.1 Deterioration

Deterioration is refer to the loss in value of the assets or facilities due to physical wearing out of that assets or facilities. It can also describe the normal wear and tear the assets or facilities experience as they age. Human factors can also cause wear and tear happens in assets or facilities by vandalism, improper routine maintenance, fire, neglect and so forth.

1.9.2 Periodic maintenance

Periodic maintenance refers to activities performed on facilities or assets based on a set time interval (Upkeep, 2002). It is used to keep the smooth running or operating of the assets or facilities in the building. Generally, these activities are planned in advance and must be implemented regardless of whether there are signs of deterioration.

1.9.3 Lifespan

The term of lifespan in this research is refer to the length of time for assets or facilities to perform their expected functions. On other words, it is the service life of the assets or facilities in functioning to serve users.

1.9.4 Expected life

Expected life is the estimation of the number of years that the assets can provide service to users. It can be said that how long the assets can last to perform their designated function in a usable condition without a termination of function or having to replace a new one. For example, we can use an elevator in the building with a expected life of 30 years and

we want to reach that point. If the elevator must be replaced 30 years in advance, we have failed to meet the expected life.

1.9.5 Defect

Any failure of facilities which refer to services, components, structures, materials and so on in the building that cannot meet the intended or design functions are called as defect. For instance, a breakdown of a fire alarm is considered as the defect because failures in function or performance. According to The Australian Glossary of Building Terms (2013, as cited in Rahmat et al., 2016) defines a defect as a fault or deviation from the intended condition of a material, assembly or component. Meanwhile, the glossary from the standpoint of a legal definition states that a, defect is a work that is in breach of the contract by failing to maintain a specified standard or quality, or is a breach of any implied warranty.

1.9.6 Failure

Failure is defined as a condition in which a component does not meet the performance requirement of its designated use. This definition includes a wide range of sophisticated features such as minor visual faults in the component, and more severe serviceability problems such as excessive deformations, premature deterioration of materials, leaking roofs and facades, etc (Feld & Carper, 1997 as cited in Shohet et al., 1999).

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

In this charter, there is a discussion of the previous research on the maintenance through literature review. According to Snyder (2019), literature review serves as a basis for knowledge development, create guidelines for policy and practice, provide evidence of an effect, and, if well conducted, have the capacity to engender new ideas and directions for a particular field. He further explained that building your research on and relating it to existing knowledge is the building block of all academic research activities, regardless of discipline. So, it is necessary to do literature review so that the researcher can understanding of what has been studied in the previous literature and also which part of areas should be focused. Therefore, the researcher is divide several subtopics from the facts and information obtained to help the researcher implement and prove the study conducted. In addition, the background of the selected case study is elaborated in this charter as well. By doing so, it can let the reader more understanding the background of the selected case study which is the SSL Headquarters.

2.2 Overview on the Background of Sabah State Library (SSL) Headquarters

This research is carried out at SSL Headquarters where located in Jalan Tasik, Off Jalan Maktab Gaya, 88300 Luyang, Kota Kinabalu (Figure 2.1). SSL Headquarters has a land area of 2.038 hectares or 5.03 acres as shown in development plan in Figure 2.2. The assets or facilities of this building are started operating on June 2004 after SSL Headquarters migrated from the old building until now. The assets or facilities of SSL Headquarters have been offered services for 17 years long. In addition to provide services to general public, it also served as the administrative office to manage all the branches in Sabah. This includes but not limited to provide resources to all the branches like books, to monitor all branches' building

and facilities maintenance and to offer employees training. However, this building consisted of eight floor, and every floor has its specific facilities and services provided as shown in appendix A.

Figure 2.1: Image of SSL Headquarters at Jalan Tasik, Luyang

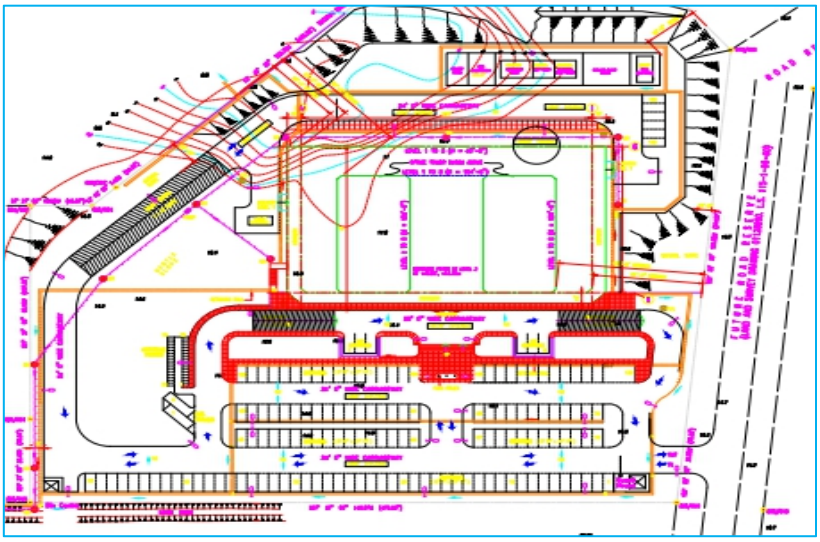

Figure 2.2: Development plan for SSL Headquarters

In fact, SSL Headquarters is a state department under the State Ministry of Education and Innovation Sabah. It is helmed by Maria Sinti who is the director of SSL Headquarters with the helping of 2 deputy director and 16 departments head. Figure 2.3 is the organization chart that can clearly demonstrate the management structure of SSL Headquarters. Besides, SSL Headquarters has its own maintenance section under department of management and administrative services (*Bahagian khidmat pengurusan dan pentadbiran*) as shown in Figure 2.4. This maintenance section is responsible for the overall maintenance planning, strategy and monitoring to all the branches in Sabah.

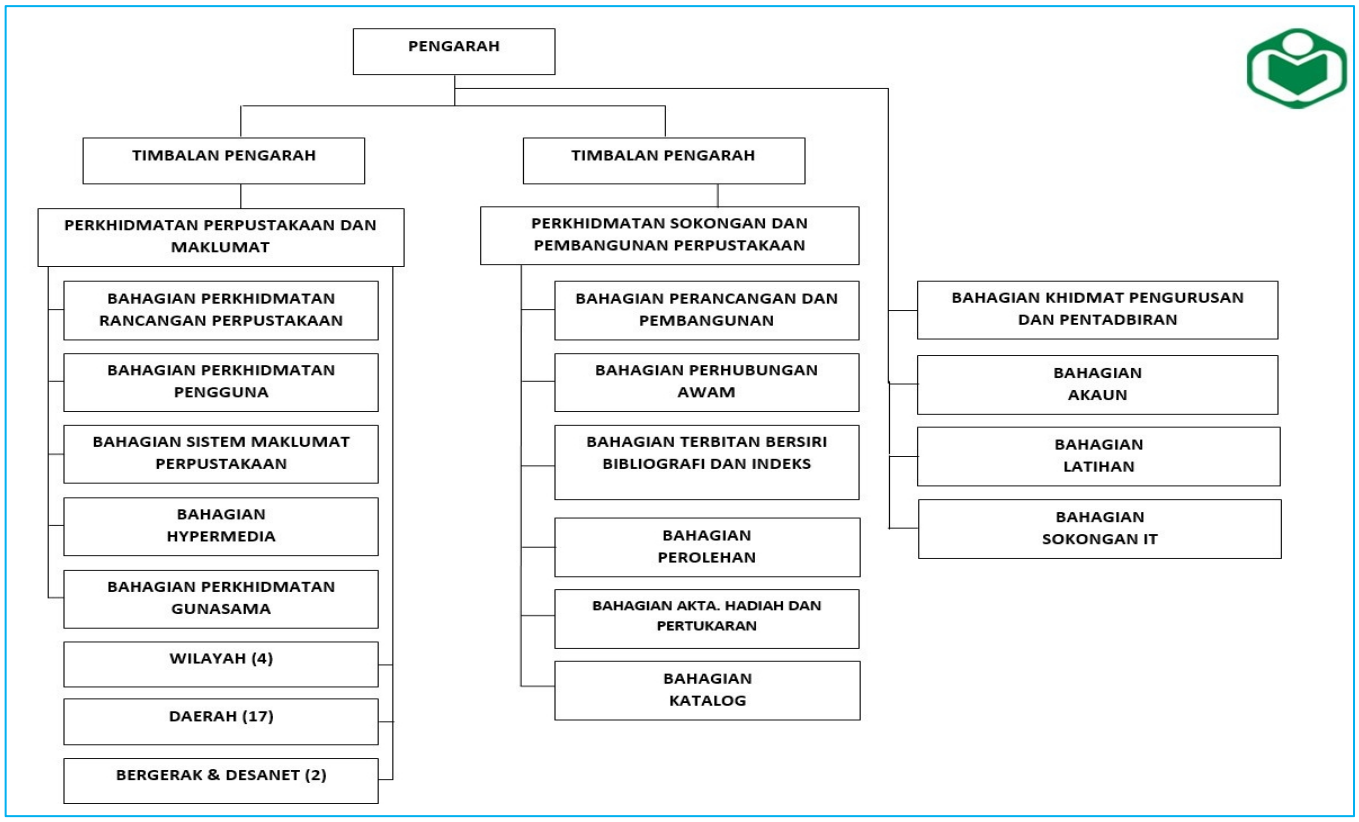

Figure 2.3: Organization chart of SSL Headquarters

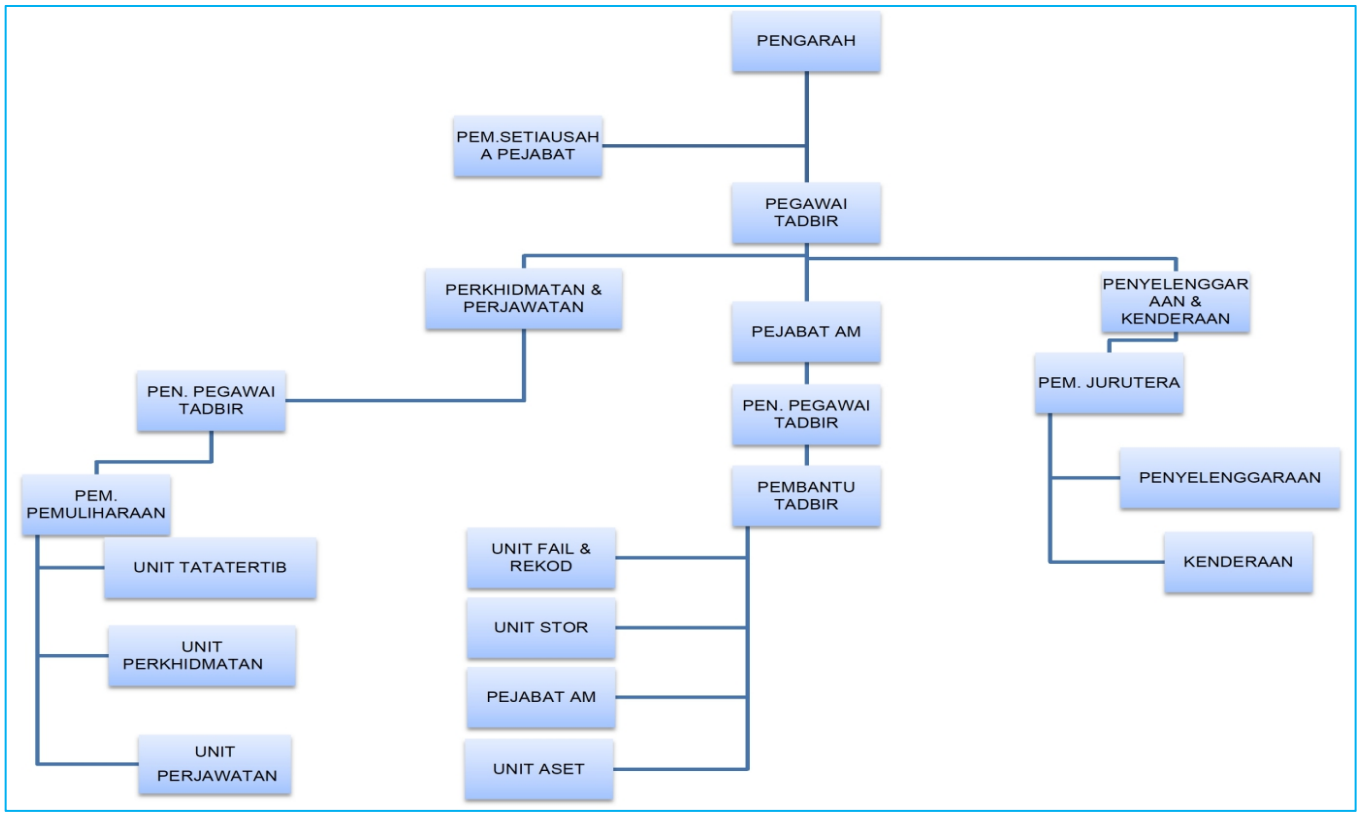

Figure 2.4: Organization chart for department of management and administrative services

2.3 Definition of Maintenance

There are many people didn't know the actual meaning of maintenance even though this is a general term and always spoke by everyone. It is necessary to figure out the definition of maintenance before understanding the concept or philosophy of maintenance. In doing so, it can make you more comprehending the principle of maintenance.

Maintenance is referred to any action, strategy, work or procedure that is being carried out to sustain required function and purpose of the assets or facilities without compromising service quality and safety matter. According to Söderholm et al. (2007), maintenance is defined as the combination of all technical and administrative actions, including supervisory actions, intended to retain an item in, or restore it to a state where it can perform a required function. While The Committee of Building Maintenance (1972, as cited in Yasin et al., 2017) stated that maintenance is the work undertaken in order to keep, restore or improve every facility, every part of the building, its services and surrounds to a currently acceptable standard and to sustain the utility and value of the facility. Fundamentally, maintenance is about minimising the risks to occupants and maximising business continuity by ensuring that building services are kept in a usable condition with minimal interruption of availability of the services (Wiggins, 2014).

On the other hand, Gits (1992) defined maintenance as the total of activities required to retain the systems in, or restore them to the state necessary for fulfillment of the production function. Another definition are suggested by Akasah et al. (2009), maintenance is a continuous operation to keep building, infrastructure, and equipment in the best form for normal use. It is also to ensure the facilities are in a good condition for a life time (Ismail & Kasim, 2013) to achieve the intended design purpose. Besides, another view of maintenance are defined by Payant and Lewis (2007), all work related to the economical preservation of facilities, equipment, and systems at a level satisfactory to perform their design functions. A more recent view of maintenance defined by Ungureanu et al. (2017), as the actions necessary for retaining or restoring a piece of equipment, machine, or system to the specified operable condition to achieve its maximum useful life.

Based on the definition of maintenance above, it can be concluded that maintenance is beneficial regarding cost, time, safety and quality conditions, avoiding unanticipated

outages, and subsequently increasing the life expectancy of critical assets (Rad et al., 2020). Thus, maintenance should be performed systematically via maintenance management. Due to maintenance management is the structured organisation of strategies, activities and plans for the upkeep of buildings, sites, equipment and facilities (Croner-i, 2019). Moreover, the goals of maintenance management is to ensure the safety and comfort of buildings users, ensuring that buildings remain fit for their intended purpose and protecting the value of estates and assets (Croner-i, 2019).

2.4 The Evolution of Maintenance Management

Maintenance management has existed from the past until now. Only stakeholders seldom to concern or neglect the importance of maintenance. This is supported by Pintelon and Gelders (1992) who stated that three or four decades ago, maintenance was simply regarded as an unavoidable and difficult to control the maintenance of assets or facilities. Over recent years, the role of maintenance has grown rapidly and plays the important role in any industry due to the view of stakeholders on maintenance has changed. This growing awareness can be attributed to the evolution of maintenance management. According to Zulkelli (2010), the evolution of maintenance management has experienced three generations since the 1930's.

Maintenance management has its origins in the manufacturing industry (Christiansen, 2021) and then applied to other industries especially in facility industry. In the early 1940's which was the first generation of maintenance management, the expectation of maintenance to "fix it when broken" was recognized by everyone. In those days, most of the equipment or assets were easy to repair and the need for skills was also lower than it is today (Zulkelli, 2010 & Muthusamy, 2015). Taking such a narrow view, maintenance activities have been confined to the reactive tasks of repair actions or item replacement (Irajpour et a., 2014). This maintenance action usually is called as reactive maintenance, breakdown maintenance, or even called as corrective maintenance. Since this maintenance technique just required fundamental repair skills for the equipment or assets.

When stepped into second generation between 1960's and 1970's, the expectation of maintenance were emphasized on "higher equipment reliability, longer equipment life and lower maintenance cost" (Dunn, 2003; Zulkelli, 2010; Palanisamy & Muthusamy, 2012; &

Muthusamy, 2015). This has led to the concept of preventive maintenance been created. On that time, this concept strictly focused on replacing parts of equipment at specific intervals based on set schedule regardless of whether that was needed or not. With the increasing cost of maintenance and operation, this led to the growth of maintenance planning and control system (Dunn, 2003; Zulkelli, 2010; Dutschke, 2014; & Muthusamy, 2015). On the other hand, it also caused the people to seek ways in maximizing the life of the equipment or assets.

In the mid-seventies that was the beginning of third generation, the expectation of maintenance has changed again with much higher expectation. The expectation of maintenance was more focused on "higher plant reliability, higher safety, better product quality, no damage to the environment, extended equipment life, and greater cost effectiveness" (Dunn, 2003; Zulkelli, 2010; Palanisamy & Muthusamy, 2012; & Muthusamy, 2015). Besides that, third generation has totally changed the basic beliefs about age and failure of equipment or assets. According to Zulkelli (2010), there is less and less correlation between the operation age of equipment or assets and the failure pattern that actually occur in practice. Moubray (1997) also agreed that age limits do little or nothing to reduce the probability of failure. On the other hand, the maintenance technique in third generation were condition-based maintenance (CBM), failure modes and effects analysis (FMEA), hazard studies, design for maintainability and reliability, small, fast and powerful computer, expert systems, and teamwork and empowerment. Figure 2.5 is briefly description of the evolution of maintenance management from first to third generation.

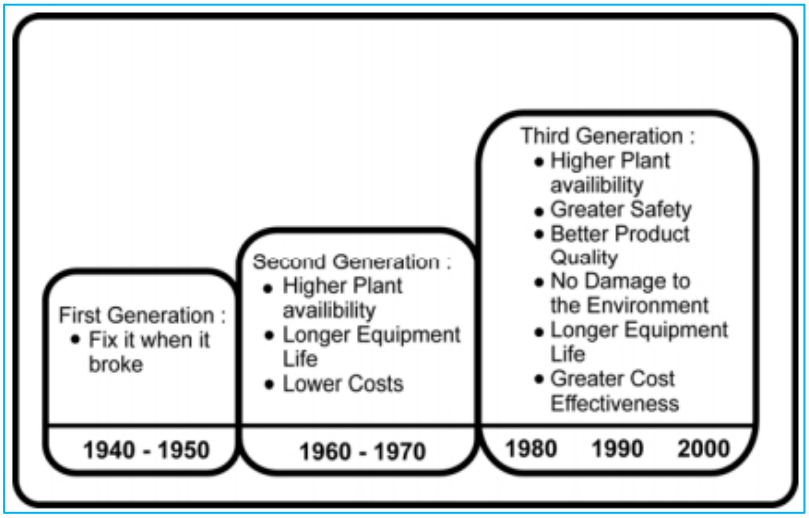

Figure 2.5: Evolution of maintenance management from first to third generation

Sourced: Zulkelli (2010); & Muthusamy (2015)

From the evolution of maintenance from first to third generation, it can be concluded that the first is characterised by a focus on repair tasks, the second by a focus on improving maintenance planning and scheduling, and the third by a focus on predicting, preventing and avoiding the consequences of assets or equipment failures (Dunn, 2003). There is no consensus in the literature on the maintenance management for fourth generation or known as current maintenance management approach. By addressing current or potential gaps in maintenance performance, a generic maintenance plan can be developed (Rastegari, 2017). All three of these generations of maintenance management should be applied in all maintenance environments based on the criticality of the assets or equipment being maintained, at any point in time (Hide, 2013).

2.5 The Importance of Maintenance Management

Effective maintenance management cannot be overlooked because maintenance plays an important role in determining the success or failure of an organization. The following is the reason why maintenance management is important in the organization:-

a) High cost of investment, maintenance and repair on machines, facilities and equipment (Zulkelli, 2010).
b) It is important element in providing quality assurance.
c) Poorly maintained resources can cause instability of the assets and equipment pause to operating or functioning.
d) Buildings, equipment and machine are growing complexity. This can lead to the potential cost of breakdown on assets or facilities becoming an increasing risk to maintenance management (FTMaintenance, 2019).
e) Increased assets or facilities availability, performance, and quality.
f) Reduce cost of maintenance and repair involved (Zulkelli, 2010).
g) Prolong the lifetime of assets or facilities, equipment, machine, and building.
h) Maximization of profit due to reduction on repair costs.
i) Manage resource and manpower more efficient.
j) Decrease the malfunction of assets or facilities, equipment, machine.
k) Ensuring the occupants of the building are not placed at risk and the assets or facilities of the building are kept in a usable condition.

2.6 Maintenance Policy

The maintenance policy is to give guidance and statement for the maintenance team or department understanding the direction and the role of maintenance plays in an organization. This can be further explained by Palanisamy and Muthusamy (2012), maintenance policy provides a policy and management framework to ensure that assets and equipment are maintained appropriately to support the organisation's strategic objectives. While Lee and Scott (2009) stated that maintenance policy is a written document, and provides a management framework to the maintenance personnel to determine appropriate maintenance strategy and standard. Moreover, a well organized maintenance policy is the main driving forces behind any successful maintenance. In turn, improper create maintenance policy may adversely affect operating budget of the company due to unplanned maintenance cost thereby reducing productivity as well as profitability (Ilangkumaran & Kumanan, 2009).

2.6.1 Objectives of Maintenance Policy

The maintenance policy must be formulated in accordance to the specific objectives in order to avoid deflection from the ultimate goal. There are seven objectives should be followed according to Palanisamy and Muthusamy (2012) as shown in Figure 2.6.

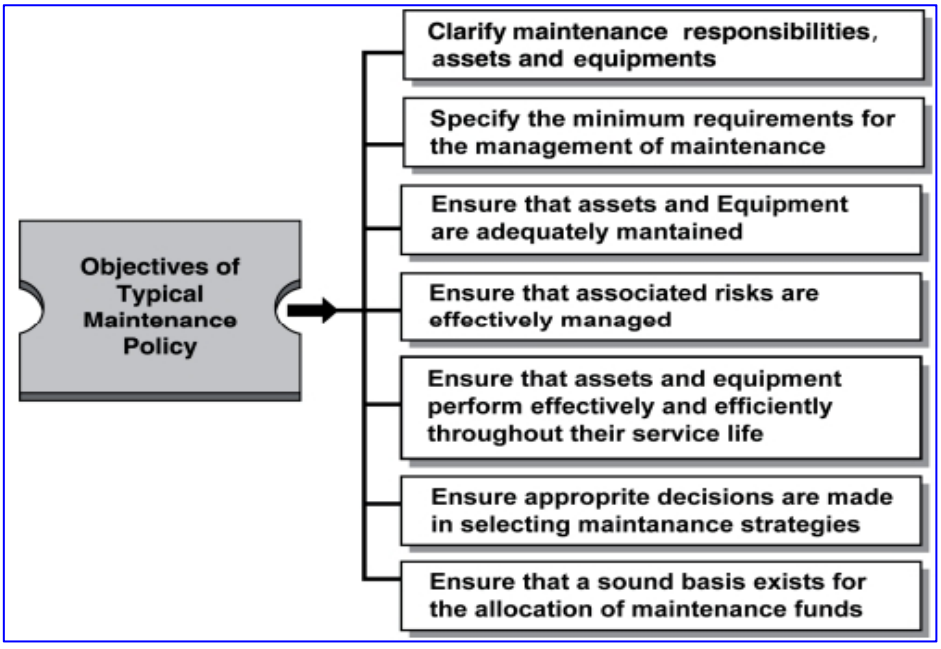

Figure 2.6: Seven objectives of maintenance policy

Sourced: Palanisamy and Muthusamy (2012)

2.7 Types of Maintenance

There have been various classifications of maintenance types (Shin and Jun, 2015). Maintenance can be divided into two types namely planned maintenance and unplanned maintenance as shown in Figure 2.7 according to category. According to Subramaniam et al. (2015), unplanned maintenance approach is normally used to maintain equipment, installations, materials, facilities or components that are small in capacity but big in quantity and have a short life span (less than 12 months). Usually, the repair or replacement is performed only when a failure occurs in this type (Ship Business, 2015). This type of maintenance is related to unforeseen problems such as early failure of equipment, installations, facilities, materials or components (Wiggins, 2014) and need to be replaced frequently resulting in uneconomical. This maintenance approach usually refer to lighting systems, end-user small power supply, electrical appliances and such.

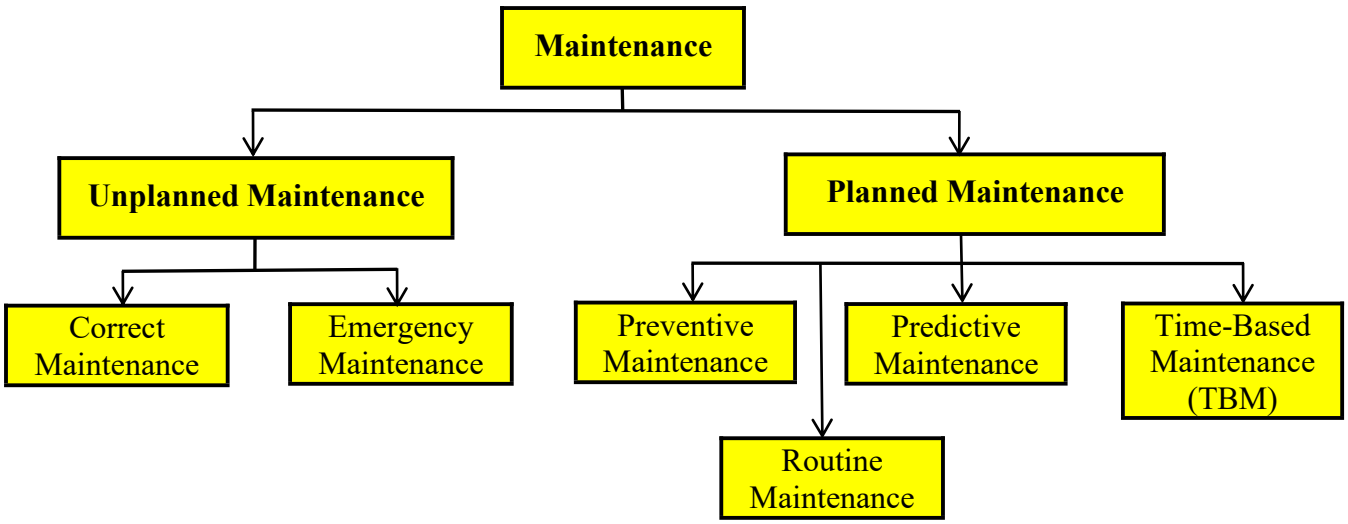

Figure 2.7: Types of maintenance

While planned maintenance is being carried out systematically based on a schedule that has been set previously. This planned maintenance contributes significantly to the continuous functionality of the equipment, installations, materials, facilities, or components and reduce possible breakdowns (Subramaniam et al., 2015). Therefore, all maintenance activities for this planned maintenance necessary to plan, control, and record. Wiggins (2014) expressed that this maintenance recognises minor faults and allows replacement prior to a major problem arises in order to ensures the state of the premises is retained in good order as well as to maintain high system reliability. In the views of Subramaniam et al. (2015), this

maintenance approach is suitable for Mechanical and Electrical (M&E) equipment located in a building plant such as air conditioning chiller units, pumps, electrical switchgears, and so on.

2.7.1 Corrective Maintenance (CM)

Corrective maintenance (CM) is the repair or replacement actions that executed to restore the expected functions after failure occurrence or upon occurrence of severe performance decline (Lin & Tseng, 2005). CM also known as run-to-failure maintenance (RTF) or failure-based maintenance (FBM) or breakdown maintenance (BM) or reactive maintenance (Azadeh & Zadeh, 2016; Patidar et al., 2017; & Rastegari, 2017). When the CM is being conducted, it's mean that the failure has now occurred. This is agreed by Irajpour et al. (2014) who stated that in the CM a problem must exist before corrective actions are taken. According to HUPJE (2021), CM can be the result of a deliberate RTF strategy. That is to say equipment or assets are allowed to fail before any repair or replacement maintenance is carried out and, as such, resources are not deployed until equipment or assets break down (Emovon et al., 2016). While Venkatesh (2007) expounded that CM improves equipment and its components so that preventive maintenance can be carried out reliably.

2.7.2 Emergency Maintenance (EM)

Emergency maintenance (EM) is sometimes called as critical maintenance (Zulkelli, 2010). This type of maintenance is the remedial works have to be carried out as soon as possible due to emergency condition of the equipment or assets failure. Usually, this maintenance works have to start on the same day as per requested. It is to avoid unacceptable consequences (Karia et al., 2014). According to Zulkelli (2010), the amount of emergency maintenance should be very small when compared to the amount of scheduled maintenance (usually less than 10 %). He further suggested that two techniques used in handling emergency maintenance are:-

a) Introducing emergency maintenance into regular maintenance with overtime, outsourcing the emergency job or hiring temporary workers.
b) Assigning a few skilled workers to only handle of emergency work orders.

2.7.3 Preventive Maintenance (PM)

According to Wang (2002), preventive maintenance (PM) is all actions performed in an attempt to retain equipment or assets in specified condition by providing systematic inspections, detection, and prevention of incipient failure. It is to mitigate the risk of catastrophic failure occur. Therefore, measures are taken to replace components or keeping them in good condition before failure could occur **(**Mat & Baharum, 2015). This is the core concept of PM to prevent sudden malfunction take place at unexpected condition. Sullivan et al. (2010) expressed that the major merit of PM is its ability to increase the average life of components and the entire building facilities and to reduce the uncertainty risk. Subramaniam et al. (2015) suggested that this type of maintenance is suitable for all major engineering equipment.

2.7.4 Routine Maintenance

Routine maintenance is the day-to-day regular upkeep of facilities and equipment to ensure the facilities and equipment are functioning well (Subramaniam et al., 2015). It is used to protect the equipment and facilities against early decay. UpKeep (2021) also agreed this perspective and then stated that companies invest in routine maintenance can extend the life of their assets, reduce emergency maintenance, and keep their facilities up and running more consistently. There are various items of work which fall under routine maintenance and are expected to be attended regularly for upkeep the equipment and facilities, some of the items need be attended daily, some weekly, while some at regular interval (Zeeshan, n.d.). They are include but not limited to housekeeping, landscaping, ground keeping, upkeep of engineering installations and so on.

2.7.5 Predictive Maintenance (PdM)

This type of predictive maintenance (PdM) can be defined as a method of surveillance used to indicate how well the equipment and facilities are, while performing their intended tasks (Ilangkumaran & Kumanan, 2009). It is often mentioned as condition-based maintenance (CBM) (Ahuja & Khamba, 2008; Palanisamy & Muthusamy, 2012; & Irajpour et al., 2014). The greatest benefit of this maintenance is able to predict imminent failure of the equipment and facilities may happen, this could avoid such failure which could cause heavy

repair costs and even safety hazards. Due to this maintenance can manifest the actual condition of equipment by using predictive technologies such as vibration analysis, infrared thermographs, ultrasonic detection and so on (Jabar, 2008) and it involves inspections at equipment running conditions and during stoppage period (Onawoga & Akinyemi, 2010). When the condition of equipment achieves certain level of deterioration that has been set, maintenance work should be taken to reinstate the equipment to the normal condition. It means that equipment is taken out of service only when direct evidence exists that deterioration has happened (Ahuja & Khamba, 2008; & Irajpour et al., 2014).

2.7.6 Time-Based Maintenance (TBM)

Time-Based maintenance (TBM) sometimes also called as age-based maintenance (ABM), or periodic maintenance (Azadeh & Zadeh, 2016; FTMaintenance, 2020; MaintainX, 2020; & UpKeep, 2021b). TBM is used to replace or renew an item or components in restoring its reliability at a fixed time, interval or usage regardless of its condition (HUPJE, 2021). By doing so, it's to ensure smooth running of the equipment or other facilities. But, it could create unnecessary maintenance works which lead to high maintenance cost. Mann (1995) explained that most of the time it is hard to define the most effective maintenance intervals due to the lack of sufficient historical data. Therefore, TBM is determined and planned by efficiently monitoring the building's elements such as walls, floors, roof and service equipment such as boilers, pumps, and heating system, to identify which element or piece of equipment requires maintenance before a major failure occurs (Horner et al., 1997). In addition to replace an item, Venkatesh (2007) stated that TBM also consists of periodically inspecting, servicing and cleaning equipment.

2.8 Maintenance Insourcing and Outsourcing

Maintenance works can be done through insourcing or outsourcing approach. According to Palanisamy and Muthusamy (2012), maintenance insourcing is utilising the existing non-maintenance personnel in a business environment to identify, prevent and avoid potential failure of equipment while maintenance outsourcing is the act of engaging external services to undertake maintenance task that are less critical to operation and also too expensive to be executed using in-house maintenance personnel. Therefore, the top management level must consider in depth whether maintenance insourcing or maintenance

outsourcing should be adopted in the organization to ensure gain the maximum profit from the decision that has been made. In order to prevent wrong decision, the top management level should follow selection criteria provided for both maintenance insourcing and maintenance outsourcing to make right decision. The selection criteria for both maintenance insourcing and maintenance outsourcing are described in the following subtopic.

2.8.1 Criteria for Maintenance Insourcing

There are seven criteria for maintenance insourcing in accordance to Palanisamy and Muthusamy (2012) as shown in Figure 2.8.

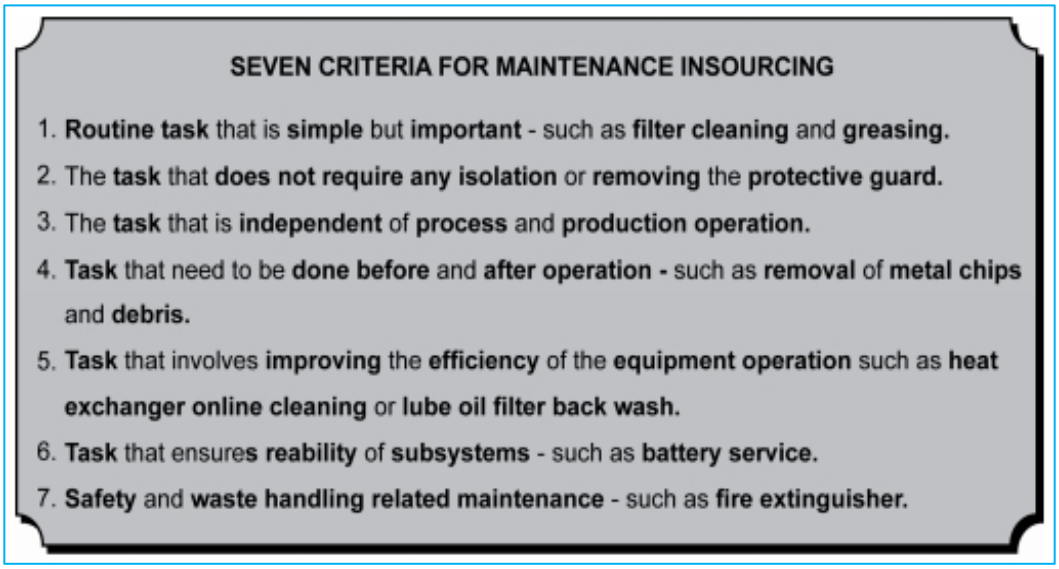

Figure 2.8: Seven criteria for maintenance insourcing

Sourced: Palanisamy and Muthusamy (2012)

2.8.2 Criteria for Maintenance Outsourcing

The criteria should be followed by maintenance outsourcing are clearly elaborated in Table 2.1 based on the suggestion of Palanisamy and Muthusamy (2012).

Table 2.1: Criteria for maintenance outsourcing

Criteria for maintenance outsourcing
1)Maintenance outsourcing involves additional cost to the existing maintenance cost. 2)The selection criteria should justify the additional cost and ensure increased effectiveness in maintenance. 3)Two types of maintenance that can be outsourced namely low priority maintenance works and high priority maintenance works. ➢ Characteristics of low priority maintenance works are:- a) Do not have any critical impact on operation. b)Done with minimum competency. c) Readily and locally available service provider. d)Minimum supervision to ensure quality of work. e) Measurable by quantity of service. f) Not done often. ● Usually refer to facility painting, cleaning services, compound management, utility services such as changing bulbs and plumbing, and so on. ➢ Characteristics of high priority maintenance works are:- a) High investment and implementation cost. b)Highly skilled maintenance staff. c) Frequent occurrence but does not have sufficient in-house knowledge to resolve. d)Rare occurrence but need expert opinion for decision making. e) Specialised equipment that are delicate and need special diagnostic and maintenance tools. ● Usually refer to condition monitoring and prediction analysis, remote monitoring and data, collection, OEM maintenance service, and so on.

Sourced: Palanisamy and Muthusamy (2012)

2.8.3 Advantages and Disadvantages of Maintenance Insourcing and Outsourcing

The advantages and disadvantages of maintenance insourcing and outsourcing also should be taken into account in advance before the decision has made. The following Table 2.2 and 2.3 are the advantages and disadvantages of maintenance insourcing and outsourcing.

Table 2.2: Advantages and disadvantages of maintenance insourcing

Advantages	Disadvantages
1)Reduction in cost on routine maintenance. 2)Prediction of potential failure at early stage. 3)Maximum utilisation of operational resources. 4)Shared responsibility of equipment reliability and availability. 5)Improved morale of operational staff towards contribution to cost reduction. 6)Enhance communication between operation and maintenance in preventing failure. 7)Improved utilisation of in-house maintenance personnel to preventive tasks and to schedule tasks. 8)Utilisation of operation personnel during machine outage for maintenance enhancement.	1)Risk of overload on operation staff and reduction in production focus. 2)Inconsistency between the qualities of insourced maintenance.

Sourced: Palanisamy and Muthusamy (2012)

Table 2.3: Advantages and disadvantages of maintenance outsourcing

Advantages	Disadvantages
1)Equipment manufacture and end user partnership. 2)Reduction of training cost for in-house staff. 3)Only direct cost of service rendered by provider. 4)Time based maintenance outsourcing enables short lead time - fast. 5)Reduction or elimination of indirect cost to maintenance in-house staff. 6)Elimination of need to hire and sustain highly skilled staff for expert service. 7)Flexibility to increase or decrease staff based on need for maintenance.	1)Risk of non-performance of outsourced service provider on production. 2)Poor quality of work or just meeting the requirement. 3)Lack of understanding on overall operation requirement. 4)Lack of holistic problem solving approach - stick to scope as stipulated/set. 5)Increased monitoring requirement to prevent service short change.

Sourced: Palanisamy and Muthusamy (2012)

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

This charter clearly discusses the research methodology used by the researcher to conduct study at SSL Headquarters. Research methodology is a method utilized to identify, select, process, and analyze data and information for the purpose in generating reliable results that can support a study. More specifically, it's about how a researcher systematically designs a study to ensure valid and reliable results that can address the research objectives (Jansen, 2020). In order to attain the objectives of this research successfully, understand the effective and professional methods of doing research so data collection and analysis can be performed properly (Hashim et al., 2017). This is to ensure that the research implementation process runs smoothly and effectively.

There are many methods can be used to gather data and information. It includes but not limited to explore theses, web pages, conferences proceedings, reports, interviews, questionnaires and so on. Therefore, the main aspects of this research in garnering data and information can be categorized into few parts namely research design, research methodology, population and sampling, data collection procedures and data analysis. These process are used to obtain the results for the research objectives that arise in this study.

3.2 Research Design

According to De Vaus (2001), William (2006) and University of Southern Carlifornia (USC, 2021) Libraries, research design is the overall strategy that researcher choose to integrate the different components of the study in a coherent and logical way, thereby, ensuring researcher will effectively address the research objectives; it constitutes the blueprint

for the collection, measurement, and analysis of data. It can guide the researcher to find and decide the suitable method for the research subject matter. Also, it is the design method to solve and answer all the objectives of research that emerge in this study. While Bryman and Bell (2003, as cited in Yunus, 2012) expressed that research design provides a framework for undertaking a research and described how the data will be collected and analyzed in order to answer the research objectives. The quality of a research design depends on how carefully researcher choose the appropriate design alternatives, taking into consideration the specific objectives, research questions, and constraints of the project, such as access to data, time, and/or money (Sekara & Bougie, 2016).

3.2.1 Research Procedure

Research procedure provides an underlying structure or model to support researcher's research efforts (Godfrey, 2019). It helps to provide guideline or route for the researcher to follow and structure research activities when doing the study. The research procedure or called as research flow chart procedure is categorized into seven phases as shown in Figure 3.1. By referring to the Figure 3.1, it show the sequences of the overall process research methodology as a guideline and procedure to be followed. The first phase involves choose the title of the study after want to start the final year project. The problem statement and determine research objectives are arranged in second and third phase respectively. The literature review is conducted in the fourth phase. While in fifth phase is the data collection via primary data and secondary data method. After data collection successfully and the follow up is data analysis and discussion in the sixth phase. And the final phase involves conclusion.

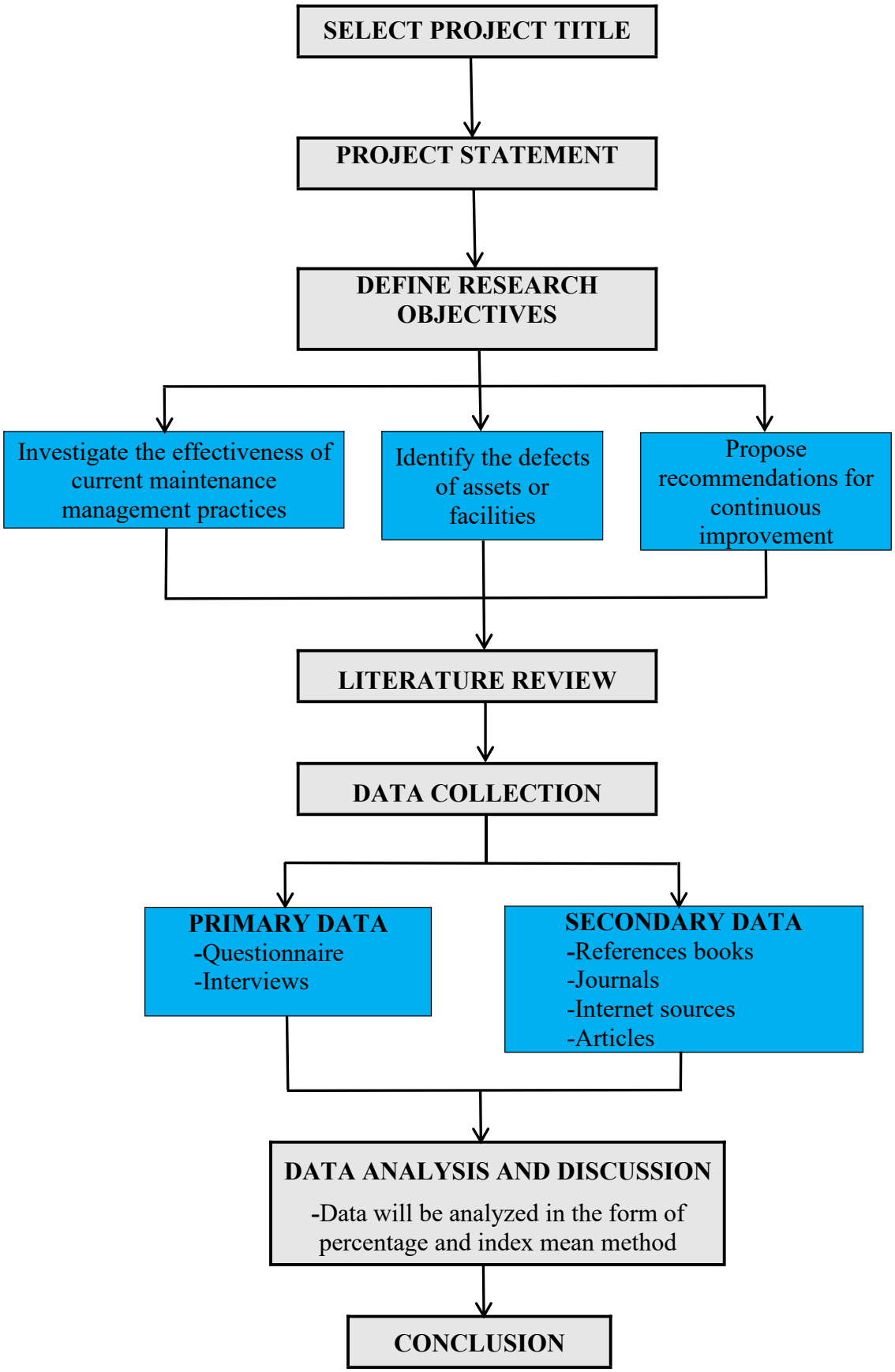

Figure 3.1: Research flow chart procedure

3.2.2 Data Collection of Research

In order to achieve the objectives of this research, it is important to have the method to source the data for this research. Due to data collection is a pivotal method to provide information on the current maintenance management at SSL Headquarters. It is also determine the success or failure of this study. In general, there are two types of data that are the primary data and secondary data as shown in Figure 3.2 .

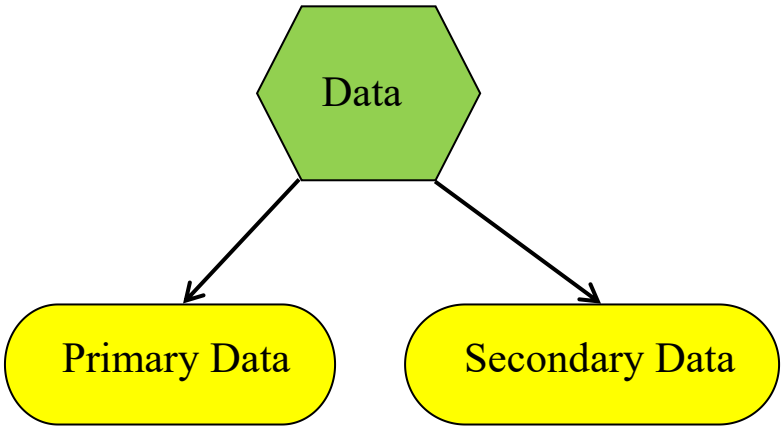

Figure 3.2: Types of data collection

a)Primary data

Primary data is a type of data that is collected by researcher directly from main sources where the data originally originates from and are regarded as the best kind of data in research (Formplus blog, 2021). On the other words, the primary data is gather from the study area. In this study, the primary data of SSL Headquarters is collected through questionnaires and interview form.

b)Secondary data

While according to Kabir (2016), secondary data is refer to the data collected from a source that has already been published in any form. It is a type of data that has already been collected by someone else in the past. Thus, the secondary data for this research is gathered through literature review like reference books, articles, internet sources, journals, records, and data archives.

3.3 Research Methodology

In order to collect the data and information effectively, several research methods are carried out in helping the researcher to study current maintenance management practices at SSL headquarters.

3.3.1 Literature review

Literature review plays the critical role in doing research. Due to literature review can help the researcher to identify and highlight the important variables, and to document the significant findings from earlier research that will serve as the foundation on which the theoretical framework for the current investigation can be built and the hypotheses developed (Sekaran, 2003). It is very useful in deciding the nature of this research based on the findings from the literature review as an evidence. Also, literature review can provide guidance to researcher with an in-depth understanding of the background of the study to avoid misconception in the research. According to McMurray et al. (2004), the purpose of a literature review is to increase the researcher's knowledge of the problem. Moreover, literature review can use as the supporting argument in the research. All of these relevant journals or sources are quoted appropriately by American Psychological Association (APA) writing style as a references section in this study to convince or as a proved statement to the reader.

3.3.2 Questionnaire

Questionnaire is one of the research instruments that are always adopted in the study. In addition to a series of questions that can be provided by the questionnaires to collect data from respondents, it is also a relatively cheap, quick and efficient way of obtaining large amounts of information from a large sample of people (McLeod, 2018). According to Child Care & Early Education Research Connections (2019), the larger the number of respondents (the larger the sample size), the more accurate will be the information that is derived from the survey. Therefore, questionnaire is applied to this research because stakeholders involved within the building are staffs and the visitors of SSL Headquarters who are always using the assets or facilities in the building. In this research, this questionnaire consisted of seven pages and is divided into three section as shown in appendix B. Section A is personal information

related to the demographic data of the respondents, section B is the perspective of respondents on the effectiveness of maintenance services at SSL Headquarters, and section C is the satisfaction degree of respondents on assets or facilities of SSL Headquarters. Besides, this questionnaire can be used as the recommendations for continuous improvement to the maintenance management practices at SSL Headquarters.

3.3.3 Interview

Interview is a two way communication system that allows ideas and information exchanged. According to Blake (2007), interview is a conversation which has a purpose and is directed towards its object by the interviewer. He added that interview is a face-to-face meeting and discussion between two or more people for a specific purpose. Therefore, it is one of the effective methods should be used in this study.

In order to get accurate detailed information on this research, interview has been adopted in this study with two officers of SSL Headquarters. The purpose of interviewing these two officers is to gain an in-depth understanding into maintenance management practices in SSL Headquarters because one of them is a maintenance head department and the other one is the technician. They are more aware of research questions in this study. Also, they are professional and experienced officers in maintenance industry. These sessions can provide important ideas and opinions from both of them, in which cannot be collected via questionnaire.

Therefore, semi-structured interview would be used in this study. According to Doyle (2020), a semi-structured interview is a meeting in which the interviewer does not strictly follow a formalized list of questions. He further explained that interviewer usually will ask more open-ended questions, allowing for a discussion with the interviewee rather than a straightforward question and answer format.

3.4 Sampling and Population

According to Babbie (2010) stated that we’re almost never able to study all the members of the population that interests us, however, and we can never make every possible observation of them. Therefore, the method of sampling can be applied on this questionnaire

population which can reflect the whole population that interests us. Both Fellows and Liu (2008) agreed that the method of sampling is to provide a practical means of enabling the data collection and processing components of research to be conducted while ensuring that the sample provides a good representation of the population. Besides, the method of convenience or purposive sampling is essentially strategic and attempts to establish good correspondence between the research questions and sampling. For this reason, researcher used the convenience or purposive sampling method in this study in order to get precise data from the population of the questionnaire.

On other hand, the population in this study is the employees of SSL Headquarters. But to acquire fair response, and to reduce the possibility of bias occurred, visitors of SSL Headquarters also include in this study. There are 110 employees working in this workplace based on the data provided by SSL Headquarters. And, the number of visitors depend on the status of the 7 days questionnaire.

3.5 Data Collection Procedures

The data collection procedure was carried out by several orderly steps for the purpose in conducting the survey smoothly. In this regard, researcher has divided several steps to obtain data from respondents of employees and visitors of SSL Headquarters as well as interview session with two employees of SSL Headquarters. The procedures of data collection are described as follows:-

- **Step 1**

  Firstly, researcher has conducted semi-structured interview sessions with head department and one technicians came from maintenance department on first day site visit at SSL Headquarters. These semi-structured interview sessions has been carried out approximately 45 to 60 minutes for each person.

- **Step 2**

  The next step was the researcher requested approval from the director of SSL Headquarters to implement questionnaire to the employees of SSL Headquarters. Due to this questionnaire involved 110 employees, it would be affected the operation of SSL Headquarters. Therefore, the researcher was asked to use Google questionnaire

form platform to share the questionnaire link via email address method. With the helping of the head department of maintenance, the shared link of the questionnaire form was successfully sent to every employees. The benefit of this Google form can allow employees to fill the questionnaire form at any time any where without interrupting their working hours. This Google questionnaire form platform was given a period of 2 weeks. After two weeks, there were only 53 collected questionnaire form via email address.

➢ **Step 3**

The researcher applied for another permission from the director of SSL Headquarters so that can conduct questionnaire to visitors within the building. Moreover, the researcher took 7 days in filling the questionnaire form for the visitors. A total of 30 visitors voluntarily conducted a questionnaire form.

➢ **Step 4**

To collect all the questionnaires form regardless of whether in paper-based form or Google online-based form. Therefore, a total of 83 sheets of questionnaire were collected. The data of questionnaire would be analyzed soon.

3.6 Data Analysis

Data analysis is how researchers go from a mass of data to meaningful insights (Bhatia, 2018). While Guru99 (2021) expressed that data analysis is a process of cleaning, transforming, and modeling data to discover useful information for research decision-making. This data analysis is very helpful in interpreting the data gathered and then taking the actionable insights based upon the data analysis.

A five point Likert Scale was used by the researcher in the questionnaire form on section B as shown in Figure 3.3. In this section B, respondents only need to tick the appropriate columns to express their perspective on effectiveness of maintenance services at SSL Headquarters. These five point Likert Scale were strongly disagree, disagree, neutral, agree, and strong agree as shown in Figure 3.3. In this section B, descriptive statistics that is percentage type will be used in the data analysis to formulate and display the actual

information obtained from the questionnaire form. The percentage of respondents will be calculated and then key in on tabular form. Also, the percentage will be displayed in the form of pie chart for easier to compare and reference. A detailed explanation will be explained in chapter 4.

Satisfaction level of respondent from disagree to agree

Strongly Disagree Sangat Tidak Setuju	Disagree Tidak Setuju	Neutral Terkecuali	Agree Setuju	Strongly Agree Sangat Setuju

Figure 3.3: Five points Likert Scale in the section B of questionnaire form

For the section C in questionnaire form, the researcher used the ranking method to identify the defects of assets or facilities at SSL Headquarters. Based on DeFranzo (2012), a ranking method asked respondents to compare a list of different items to one another. For instance, place the number 1 to 10 to assess satisfaction degree of respondents on assets or facilities where 1, 2, and 3 for frequent happen, 4, 5, 6, and 7 for neutral and 8, 9, and 10 for less happen as shown in Figure 3.4. In this section C, the answer of each respondent is calculated by using index mean calculation. Through this index mean calculation, the data analysis of this section C is easily to produce the result of the most preferred answer choice by the respondents.

Rating Scale Skala Penilaian									
Frequent Happen Kerap Berlaku			→	Neutral Terkecuali		→	Less Happen Kurang Berlaku		
1	2	3	4	5	6	7	8	9	10

Figure 3.4: Raking method used in the section C in questionnaire form

CHAPTER 4

RESULT AND DISCUSSION

4.1 Introduction

This chapter focuses on the analysis of data findings based on the research instruments used namely questionnaire. This analysis could be conducted after the researcher collected the questionnaire from the respondents. The findings of the study would be analyzed to answer all the research objectives posed by the researcher as stated in chapter one as follows:-

a) To study the effectiveness of current maintenance management practices at SSL Headquarters.
b) To identify the defects of the assets or facilities at SSL Headquarters.
c) To propose recommendations for continuous improvement

Therefore, in this chapter would be divided into two main parts. The first part was the questionnaire carried out at SSL Headquarters. A total of 83 questionnaire was collected (53 employees and 30 visitors) in this study. And the second part was the semi-structured interview conducted with two officer who from the maintenance department.

4.2 Questionnaire Analysis

The questions in the questionnaire was divided into three sections, in which section A was personal information about the background of the respondents. It included gender, age, academic background, position at SSL Headquarters, and working experience at SSL Headquarters. While section B and C were the main questions related to the actual status of maintenance service at SSL Headquarters.

4.2.1 Section A: Respondent's Background (Demography)

Table 4.1: Summary data for gender of respondents

PART A: QUESTION 1						
Gender	**Employees**		**Visitors**		**Total Number of respondents**	
	Frequency	**Percentage (%)**	**Frequency**	**Percentage (%)**	**Frequency**	**Percentage (%)**
Male	23	43.4%	13	43.3%	36	43.4%
Female	30	56.6%	17	56.7%	47	56.6%
Total	53	100%	30	100%	83	100%

1) Gender

The summary data for gender of respondents could be obtained by questionnaire to both employees and visitors at SSL Headquarters as shown in Table 4.1. The status of gender very influential in this study because the gender can let us more understanding the population structure contents of the SSL Headquarters regardless of whether employees or visitors. From the analysis of this data collected, it can be seen that 43.4% of respondents are male employees from the SSL Headquarters and 43.3% of respondents are male visitors. While the female employees of SSL Headquarters account for 56.6% and 56.7% are the female visitors. The situation shows that no matter from the employee group or the visitor group, the average gender of SSL Headquarters is mostly female. It can also refer directly on the total number of respondents, of which women accounted for the majority with 56.6%. Figure 4.1 is clearly shows the percentage for gender of respondents at SSL Headquarters.

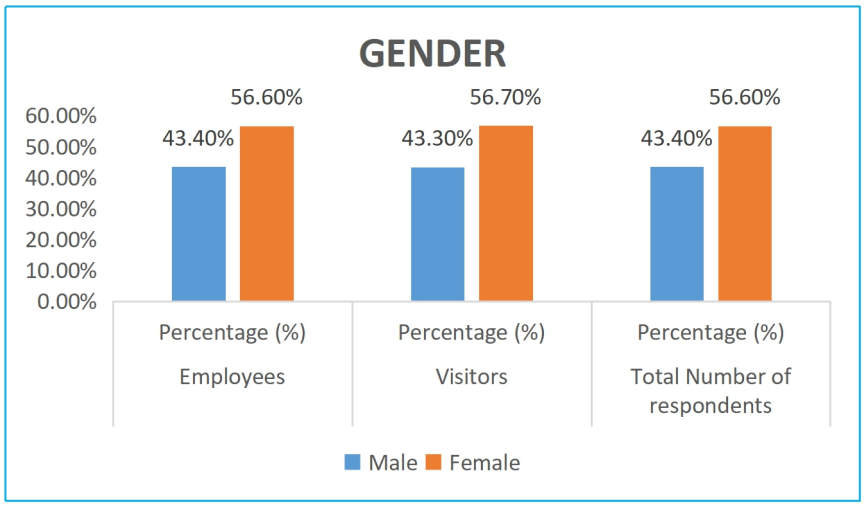

Figure 4.1: Percentage for gender of respondents

Table 4.2: Summary data for age of respondents

PART A: QUESTION 2						
Age	**Employees**		**Visitors**		**Total Number of respondents**	
	Frequency	**Percentage (%)**	**Frequency**	**Percentage (%)**	**Frequency**	**Percentage (%)**
29 years and below	13	24.5%	21	70%	34	41%
30 - 39 years	30	56.6%	5	16.7%	35	42.1%
40 - 49 years	8	15.1%	3	10%	11	13.3%
50 years and above	2	3.8%	1	3.3%	3	3.6%
Total	53	100%	30	100%	83	100%

2) Age

Table 4.2 displays the demographic data by age for the questionnaire that is implemented at SSL Headquarters. There are four groups of age in this part which beginning from 29 years and below, 30-40 years, 40-49 years, and 50 years and above. The total of respondents in this study consisted of 53 employees and 30 visitors, of which 29 years and below are 24.5% employees and 70% are visitors, 30-39 years are 56.6% employees and 16.7% visitors, 40-49 years are 15.1% employees and 10% are visitors, and 50 years and above accounted for 3.8% employees while 3.3% are visitor which is 1 person only. Therefore, it can be concluded through this collected data most of the age range for employees are middle-aged people (30-39 years) and most of the young people (29 years and below) are visitors. Both of these two groups accounted for 41% of 29 years and below and 42.1% of 30-39 years respectively for the total number of respondents as shown in Figure 4.2. Besides, it can be said that people of these two age groups are very sensitive to the surrounding environment and have the courage to express their thinking.

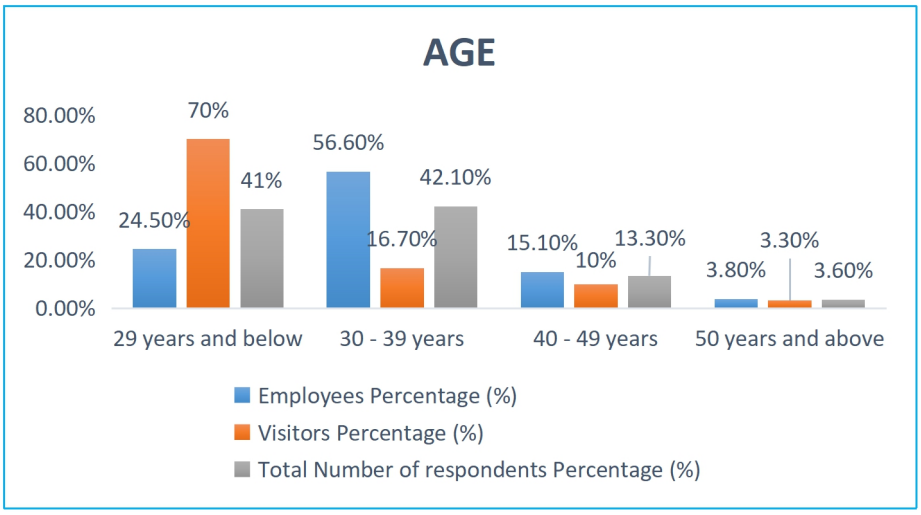

Figure 4.2: Percentage for age of respondents

3) Academic Background

Through this collected data by questionnaire, it can let us know the academic background of respondents. Thus, the academic background is only listed into five sections that are master/PhD, bachelor degree, diploma, SPM, and uneducated. The collected data are analyzed from the collected questionnaire form and summarized in Table 4.3.

Table 4.3: Summary data for academic background of respondents

PART A: QUESTION 3						
Academic Background	**Employees**		**Visitors**		**Total Number of respondents**	
	Frequency	**Percentage (%)**	**Frequency**	**Percentage (%)**	**Frequency**	**Percentage (%)**
Master/PhD	2	3.8%	0	0%	2	2.4%
Bachelor Degree	33	62.3%	12	40%	45	54.2%
Diploma	13	24.5%	10	33.3%	23	27.7%
SPM	4	7.5%	8	26.7%	12	14.5%
Uneducated	1	1.9%	0	0%	1	1.2%
Total	53	100%	30	100%	83	100%

According to the Table 4.3, the majority of academic background for both classification groups of employees and visitors are bachelor degree holder which accounted for 62.3% and 40% respectively. Meanwhile, a total of both groups for bachelor degree holder

accounted for 54.2% and diploma holder accounted for 27.7% out of a total of 83 respondents as shown in Figure 4.3. Therefore, it can draw conclusion most of the respondents are high level of knowledge compared to other respondents' academic background. While the rest are SPM holder consists of 14.5%, master/PhD holder accounts for 2.4% and Uneducated is 1.2% that is 1 person only.

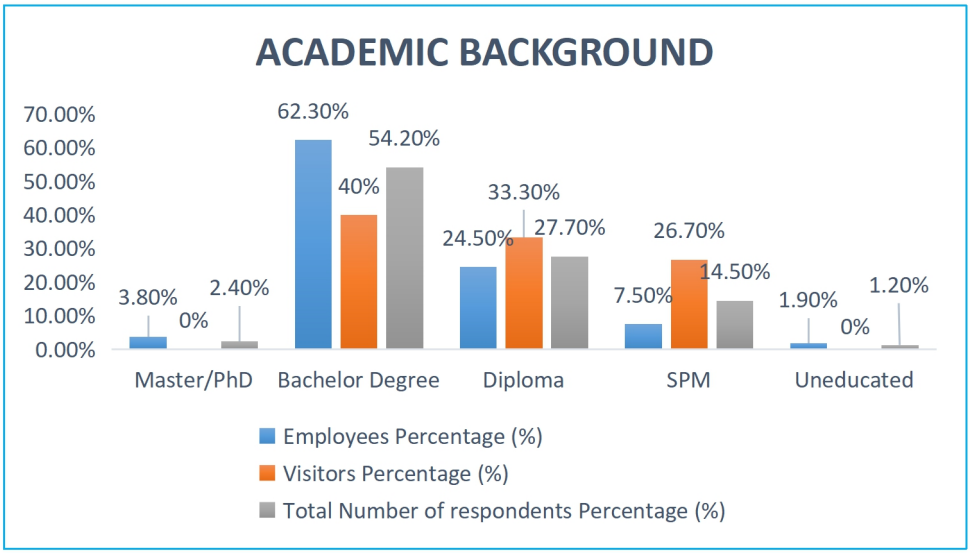

Figure 4.3: Percentage for academic background of respondents

4) Position of respondents at SSL Headquarters

Next, the position of respondents at SSL Headquarters is simply categorize into three section in the questionnaire form namely management level, general staff and visitor. It's clear that the visitors group consisted of 30 respondents who are not the employee of the SSL Headquarters. Then, the data of the questionnaire forms are summarized in Table 4.4.

Table 4.4: Summary data for position of respondents at SSL Headquarters

PART A: QUESTION 4		
Position at SSL Headquarters	**Frequency**	**Percentage (%)**
Management level	7	8.4%
General Staff	46	55.4%
Visitor	30	36.2%
Total	83	100.0%

According to the Table 4.4, it shows the detail number and percentage of respondents' (frequency) position in the questionnaire. While the Figure 4.4 is more clearly display the percentage of respondents' position at the SSL Headquarters. From the Table 4.4 and Figure 4.4, most of the respondents involved in this study are the general staffs accounted for 55.4%. This is followed by the 30 respondents with 36.2% of visitors and 8.4% are management level. The result displays general staffs are the majority respondents for this study because this group of respondents are the major manpower at SSL Headquarters. Moreover, the visitors became the second rank in this study because they are the actual users of this building's facilities.

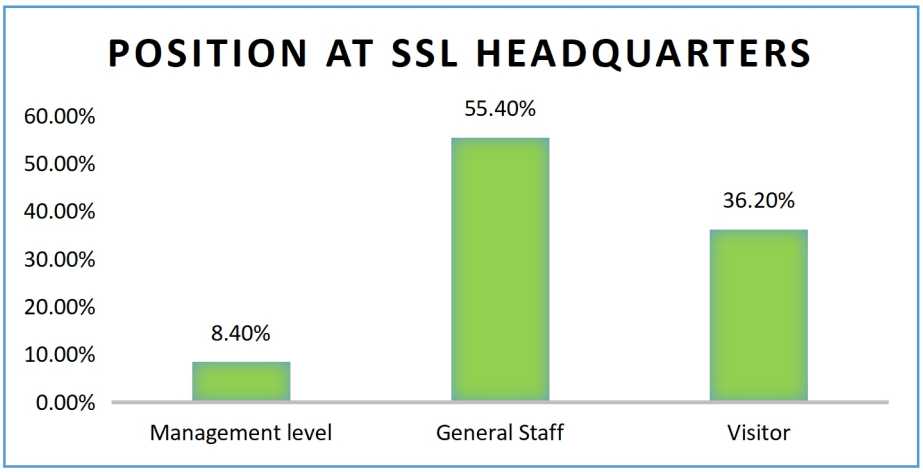

Figure 4.4: Percentage for position of respondents at SSL Headquarters

4) Working Experience of Respondents at SSL Headquarters

Table 4.5: Summary data for working experience of respondents

PART A: QUESTION 5		
Working Experience	**Frequency**	**Percentage (%)**
Less than 3 years	0	0%
3 to 6 years	3	5.7%
6 to 10 years	13	24.5%
More than 10 years	37	69.8%
Total	53	100.0%

◆ 30 visitors no need to collect the data of working experience.

According to the Table 4.5, it shows the working experience of 53 respondents which are the employees of SSL Headquarters and the 50 visitors exclude in this part of working experience since they are not the employees of SSL Headquarters. From the Table 4.5, it clearly display that 37 respondents (69.8%) have more than 10 years working experience. This is followed by 13 respondents (24.5%) have 6 to 10 years and 3 respondents (5.7%) have 3 to 6 years working's experience. Therefore, it can draw conclusion most of the respondents have more than 10 years working experience because they are the senior employees who are working at SSL Headquarters from junior till now. Also, no respondent (0) of less than 3 years working experience because there is no new recruitment in three years.

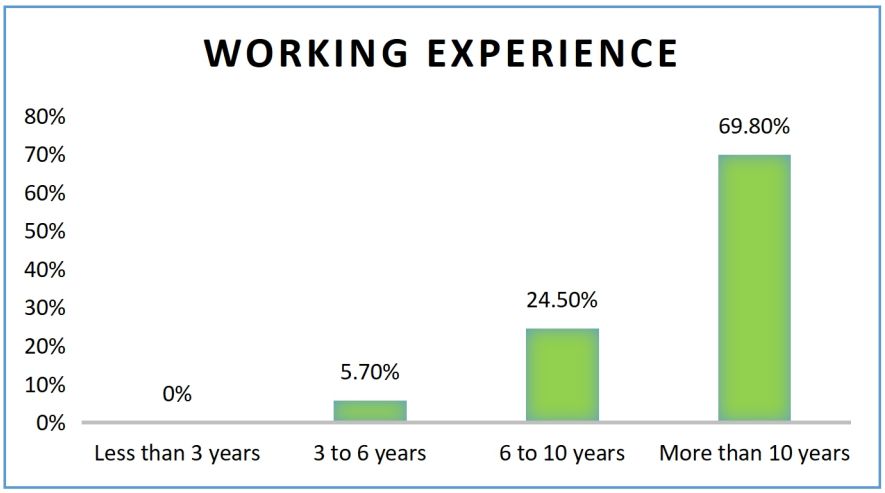

Figure 4.5: Percentage for working experience of respondents at SSL Headquarters

4.2.2 Section B: Perspective of Respondents on Effectiveness of Maintenance Services at SSL Headquarters

Section B is to explore the research questions in the questionnaire based on the instruments used to answer the research objectives. This section contains 10 questions measured using a 5 types of likert scale including strongly agree, agree, not sure, disagree and strongly disagree. The questions in section B are focus on the perspective of respondents about maintenance services at SSL Headquarters. Therefore, the results of the answer would be broken down into percentages of the total 83 respondents. Then, the results are listed into Table for each data of question together with the pie chart to show the difference of percentage for the answer. The following are the data analysis of each question:-

1)Do you agree that the facilities service provided by SSL Headquarters are satisfactory?

Table 4.6: Summary data for facilities service satisfaction

Likert Scale	Frequency	Percentage (%)
Strongly Agree	27	32.5%
Agree	24	28.9%
Not Sure	15	18.1%
Disagree	15	18.1%
Strongly Disagree	2	2.4%
Total	83	100%

According to Table 4.6, it shows the summary data for the facilities service satisfaction. Most of the respondents are choose for strongly agree with 32.5%. This is followed by 28.9% choose for agree, 18.1% respondents choose for not sure and disagree respectively, and 2.4% choose for strongly disagree. Based on the Figure 4.6, it's clear to show that 61.4% respondents satisfactory to the facilities service at SSL Headquarters which are represent by strongly agree with 32.5% and agree with 28.9% respectively. Based on the number of percentage of the satisfactory degree, it can be said that the quality of maintenance services of the SSL Headquarters is on the right track. But the maintenance services of the SSL Headquarters still have a lot of room for improvement because there are still have 20.5% unsatisfactory voice in this study which are represent by strongly degree with 2.4% and disagree with 18.1%.

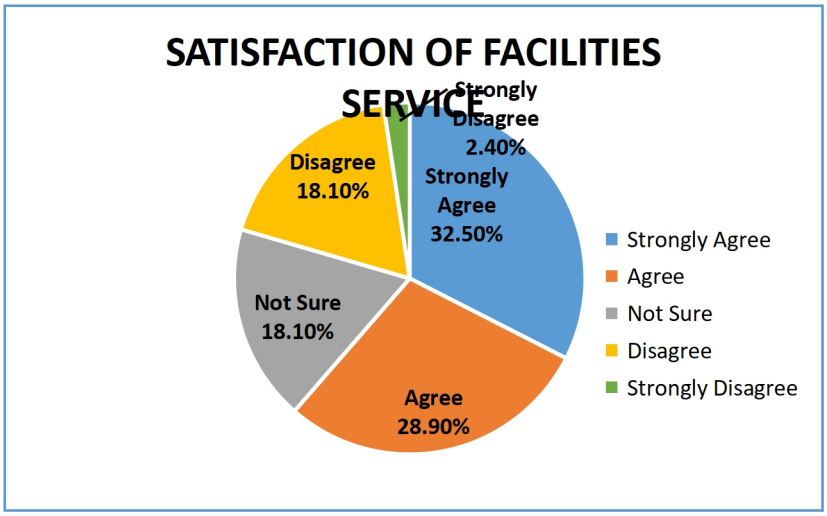

Figure 4.6: Percentage differences of satisfactory degree on facilities service

2)Do you agree that maintenance services play the important role at SSL Headquarters?

Table 4.7: Summary data for opinions on the importance of maintenance services

Likert Scale	Frequency	Percentage (%)
Strongly Agree	53	63.9%
Agree	23	27.7%
Not Sure	7	8.4%
Disagree	0	0%
Strongly Disagree	0	0%
Total	83	100%

Table 4.7 is the summary data for opinions on the importance of maintenance services at SSL Headquarters. It shows that 63.9% respondents choose strongly agree, 27.7% respondents choose agree, and 8.4% respondents not sure. The facilities service of SSL Headquarters either good or bad is easier feel and see by the surrounding people. Therefore, the respondents can assess how important the role of maintenance services play at SSL Headquarters. From the collected data through questionnaire, most respondents believe that maintenance services are very important to the library with 91.6% respondents where 63.9% choose strongly agree and agree of 27.7% as shown in Figure 4.7.

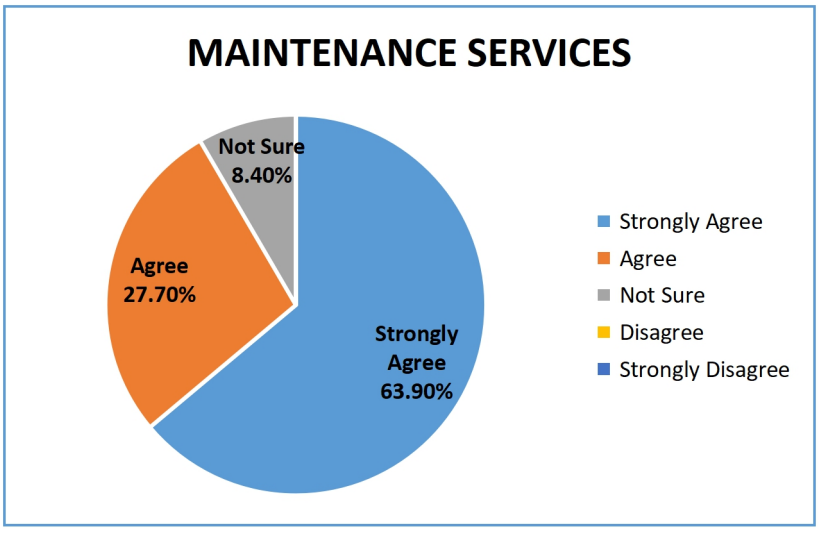

Figure 4.7: Percentage difference of opinions on the importance of maintenance services

3)Do you agree that maintenance services arrange properly at SSL Headquarters?

Table 4.8: Summary data for arrangement of maintenance services

Likert Scale	Frequency	Percentage (%)
Strongly Agree	16	19.3%
Agree	40	48.2%
Not Sure	20	24.1%
Disagree	7	8.4%
Strongly Disagree	0	0%
Total	83	100%

According to the Table 4.8, it shows that the feedback of respondents toward arrangement of maintenance services at SSL Headquarters. There are 19.3% respondents strongly agree, 48.2% respondents agree, 24.1% are not sure, and 8.4% disagree. When refer to the Figure 4.8 that is the pie chart demonstrates the percentage of respondents, it can be concluded that the maintenance services are arrange quite good with more than half of respondents with 67.5% respondents support to the maintenance practices of SSL Headquarters. These majority supporters are accounted for 19.3% strongly agree and 48.2% agree.

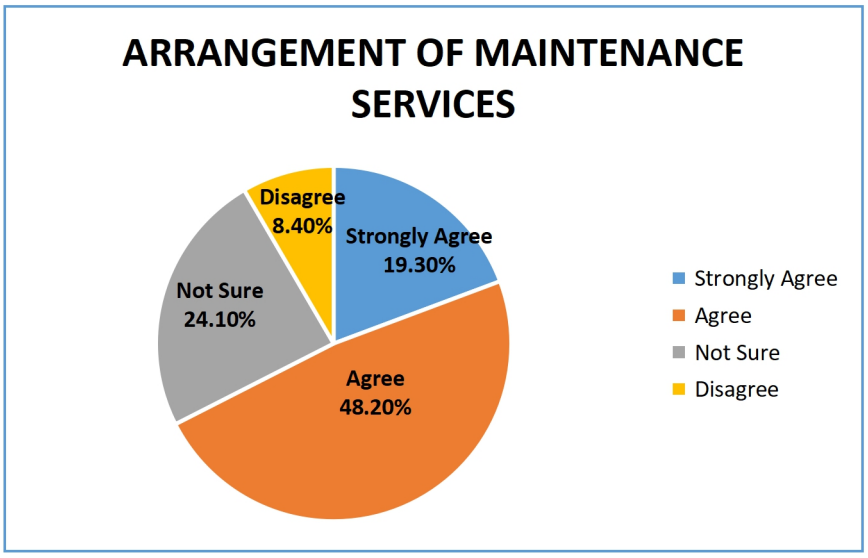

Figure 4.8: Percentage difference for arrangement of maintenance services

4)Do you agree that maintenance services at SSL Headquarters should be improved?

Table 4.9: Summary data for improvement of maintenance services

Likert Scale	Frequency	Percentage (%)
Strongly Agree	27	32.5%
Agree	37	44.6%
Not Sure	5	6.0%
Disagree	10	12.1%
Strongly Disagree	4	4.8%
Total	83	100

Table 4.9 is the summary data obtained from the questionnaire related to the perspective of respondents whether the maintenance services at SSL Headquarters should be improved. It clearly demonstrates most of the respondents support the maintenance services of SSL Headquarters should be improved with strongly agree contributes to 32.5% while agree contributes to 44.6% as shown in Figure 4.9. Both of these figures equal to 77.1% respondents out of 100%. It's mean that the employees also support maintenance services should be improved due to the majority respondents are employees of SSL Headquarters who accounted for 53 respondents out of 83. However, there are still have 12.1% respondents disagree and 4.8% respondents strongly disagree maintenance services of SSL Headquarters should be improved as well as 6.0% respondents not sure the answer.

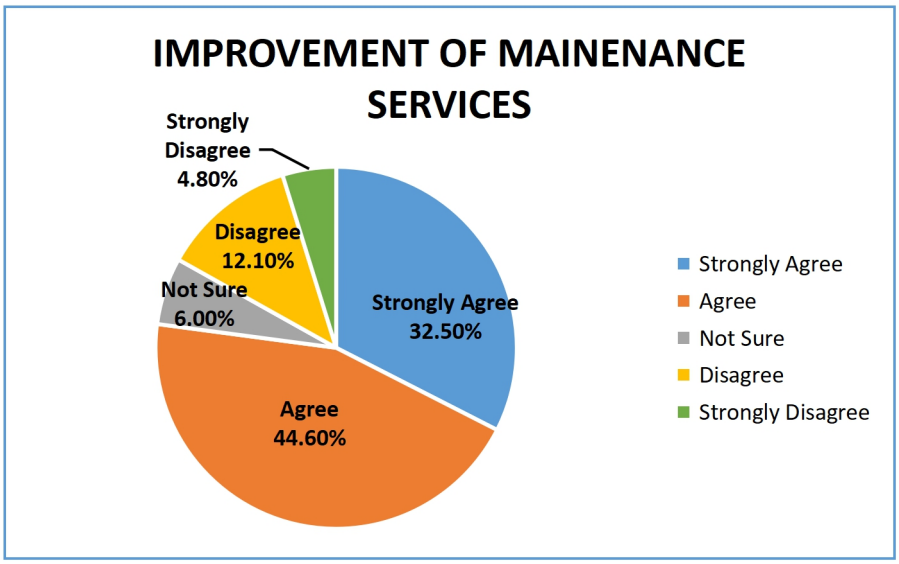

Figure 4.9: Percentage difference for improvement of maintenance services

5)Do you agree that the condition of facilities failure often occur at SSL Headquarters? (E.g. roof leaking, plumbing leaking, breakdown of AHU, etc.).

Table 4.10: Summary data for condition of facilities at SSL Headquarters

Likert Scale	Frequency	Percentage (%)
Strongly Agree	0	0%
Agree	7	8.4%
Not Sure	15	18.1%
Disagree	26	31.3%
Strongly Disagree	35	42.2%
Total	83	100%

This question is refer to the condition of facilities at SSL Headquarters. According to the summary data of Table 4.10 or percentage demonstration of Figure 4.10, it clearly show that 73.5% respondents not agree the condition of facilities at SSL Headquarters often breakdown. It's mean that 73.5% majority respondents consisted of 42.2% strongly disagree and 31.3% disagree the condition of facilities are very poor. This condition of facilities included but not limited to roof leaking, failure of elevator, breakdown of lighting system and such. Moreover, there are still have 8.4% respondents agree and 18.1% respondents not sure the condition of facilities at SSL Headquarters.

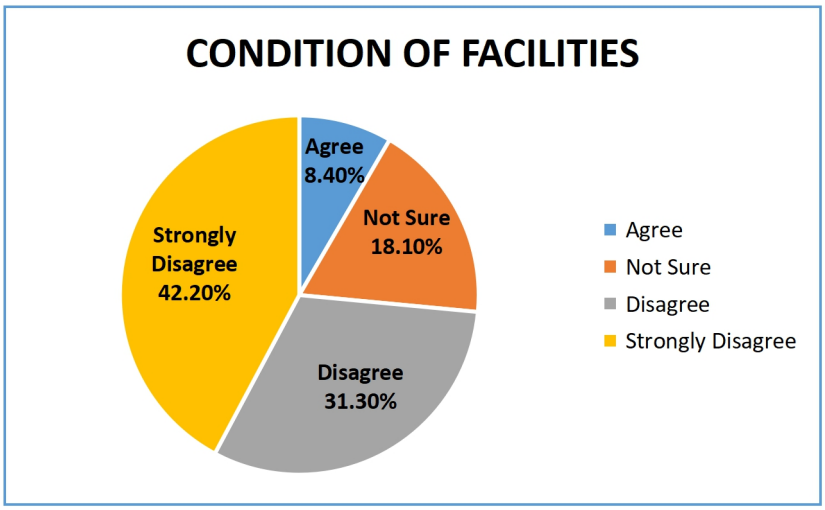

Figure 4.10: Percentage difference for condition of facilities at SSL Headquarters

6)Do you agree that facilities of SSL Headquarters giving you safety risks?

Table 4.11: Summary data of safety hazards at SSL Headquarters

Likert Scale	Frequency	Percentage (%)
Strongly Agree	0	0%
Agree	0	0%
Not Sure	1	1.2%
Disagree	35	42.2%
Strongly Disagree	47	56.6%
Total	83	100%

This sixth question refers to the feeling or perspective of respondents towards the safety risks of facilities at SSL Headquarters. From the answers given by the respondents, most of the respondents have 98.8% positive thinking towards the safety risks of facilities which are 56.6% respondents strongly disagree and 42.2% respondents disagree. While there are still got 1.2 % choose for not sure the answer. This proves that the facilities of SSL Headquarters has slightly weakness that is not able to provide quality assurance to the end-user or respondent. It can be seen that the value of respondents who are comfortable is higher than lower one. It also prove that there are only a few weakness that cause discomfort to the respondents who choose not sure. Figure 4.11 as shown in below is the percentage difference for the answers of the respondents of SSL Headquarters.

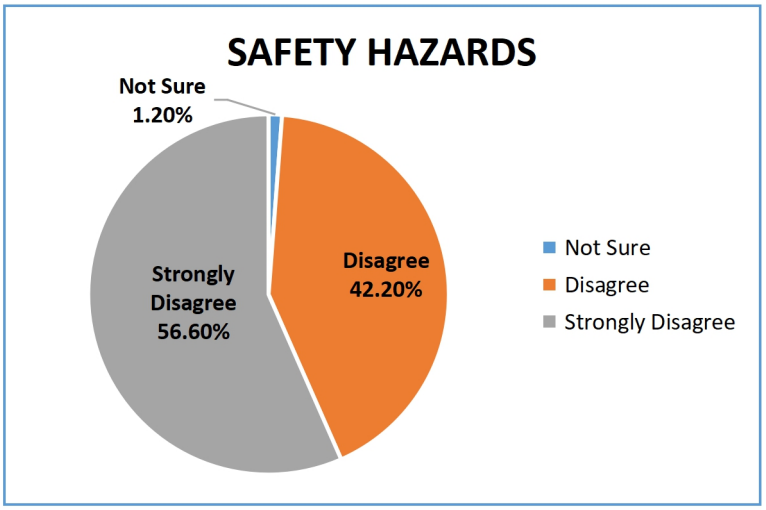

Figure 4.11: Percentage difference for safety hazards at SSL Headquarters

7)Do you agree that the drainage system around the SSL Headquarters is well maintained and does not cause flooding?

Table 4.12: Summary data for the maintenance of drainage system

Likert Scale	Frequency	Percentage (%)
Strongly Agree	38	45.8%
Agree	40	48.2%
Not Sure	5	6.0%
Disagree	0	0%
Strongly Disagree	0	0%
Total	83	100%

The eighth question is very important because it involved the issue of flooding that related to the drainage system of SSL Headquarters. According to Table 4.12 or Figure 4.12, there are no objection voices regarding the maintenance of the drainage system at SSL Headquarters. But, only 6% of respondents who choose not sure the maintenance of drainage system. These minor percentage appear, it is likely that the respondent has never experienced heavy rain at SSL Headquarters. Therefore, they didn't know the actual condition of water flow of the drainage system. On the other hand, 94% majority respondents who are acknowledged well-maintained services on the drainage system. They are 45.8% respondents who choose strongly agree and 48.2% respondents who choose agree respectively.

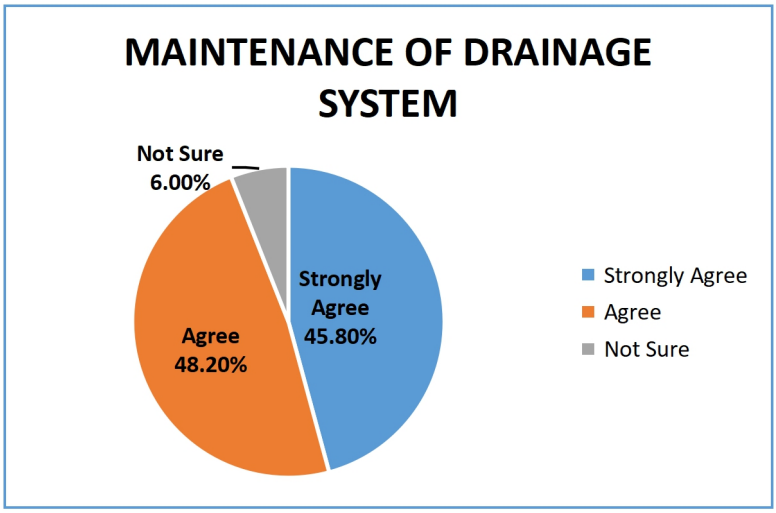

Figure 4.12: Percentage difference for maintenance of drainage system

8)Do you agree that cleaning is often done well at SSL Headquarters?

Table 4.13: Summary data for cleaning condition of SSL Headquarters

Likert Scale	Frequency	Percentage (%)
Strongly Agree	60	72.3%
Agree	18	21.7%
Not Sure	5	6.0%
Disagree	0	0%
Strongly Disagree	0	0%
Total	83	100%

This question is related to the cleaning condition of SSL Headquarters and the collected data is then summarized into Table 4.13. From the summary data analysis in Table 4.13 or the percentage displays in Figure 4.13, majority of respondents believe cleaning are done often at SSL Headquarters. Therefore, it can be concluded that the cleaning condition of SSL Headquarters is well done and organized that can obtain great supporting from the respondents. Based on the Figure 4.13, majority of respondents accounted for 94% that are the sum for 72.3% respondents who strongly agree and 21.3% respondents who agree. But, still have a small portion of respondents accounted for 6.0% who do not sure the cleaning condition of SSL Headquarters.

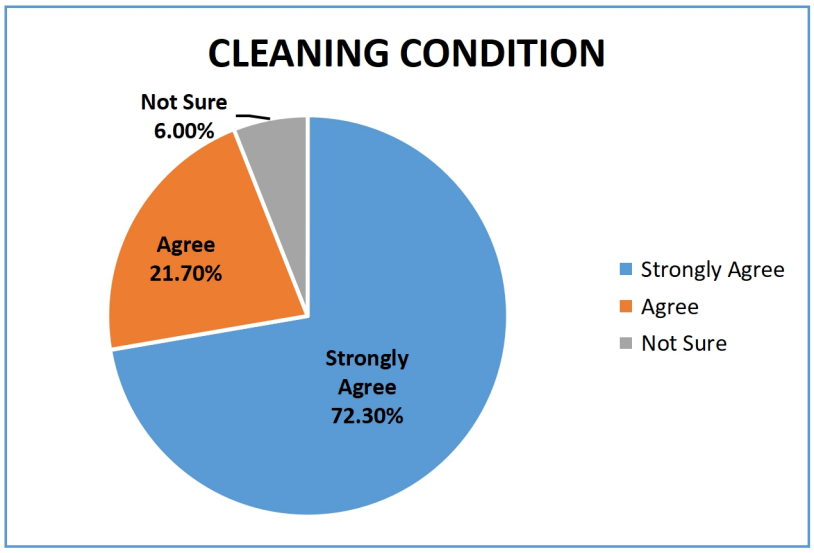

Figure 4.13: Percentage difference for cleaning condition

9)Do you agree that the maintenance of the interior and exterior building paint works is essential to keeping SSL Headquarters like new for longer?

Table 4.14: Summary data for maintenance of the interior and exterior building paint works

Likert Scale	Frequency	Percentage (%)
Strongly Agree	33	39.8%
Agree	40	48.2%
Not Sure	7	8.4%
Disagree	3	3.6%
Strongly Disagree	0	0%
Total	83	100%

This question is directly related to the building whether it can retain like new for longer should the paint works of the building are well maintained. By the collected data from the questionnaire and then summarized into Table 4.14, it shows that a large number of respondents tend to believe well maintained of building paint works can help to keep the building like new for longer. This is because the well maintained of building paint not only make the people visually feel good, it also the most effective way to make people enjoy the surrounding built environment. It's not surprisingly majority of respondents tend to support well maintained of building paint works is important. Therefore, a total of 88% majority respondents who support building paint works should be well maintained. The majority of these respondents consisted of both 39.8% respondents and 48.2% respondents respectively who choose strongly agree and agree. This is followed by 8.4% respondents who not sure and 3.6% respondents who strongly disagree.

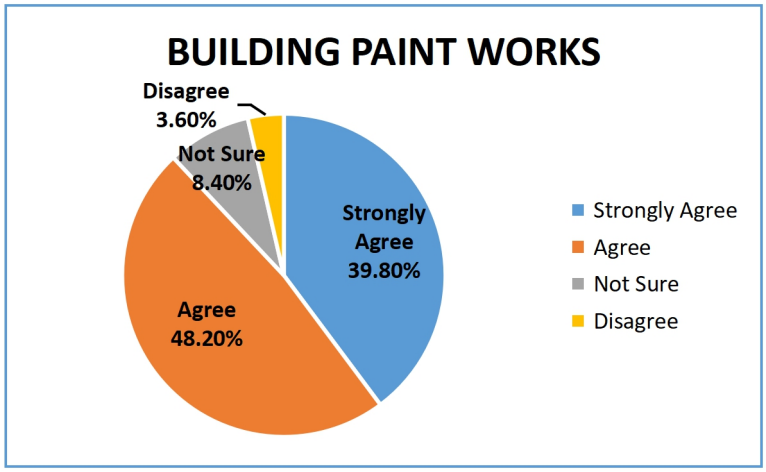

Figure 4.14: Percentage difference for maintenance of the interior and exterior building paint works

10)Do you agree that the building service life of SSL Headquarters can be as long as 50 years?

Table 4.15: Summary data for building service life of SSL Headquarters

Likert Scale	Frequency	Percentage (%)
Strongly Agree	5	6.0%
Agree	28	33.7%
Not Sure	39	47%
Disagree	11	13.3%
Strongly Disagree	0	0%
Total	83	100%

There are 47% majority respondents choose not sure the building service life of SSL Headquarters can be last for 50 years by analysis of the collected data in Table 4.15. Even though most of the respondents have bachelor degree holder as discussed earlier in section A with 54.2% (Table 4.3), most of them still choose not sure as their answer. It can be concluded that most of the respondents are not not professional scholars with a maintenance or construction background. Therefore, it's not amazing they choose not sure because of their background reason they don't want to provide inaccurate information. Apart from that, the rest of respondents choose strongly agree with 6.0%, agree with 33.7%, and disagree with

13.3%. Refer to Figure 4.15 which is clearly displays the percentage difference of respondents' selection on building service life.

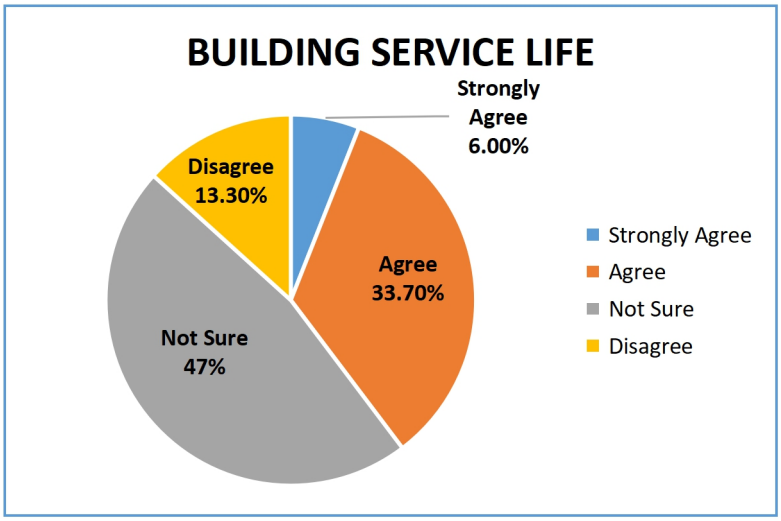

Figure 4.15: Percentage difference for building service life of SSL Headquarters

4.2.3 Section C: Satisfaction Degree of Respondents on Assets or Facilities of SSL Headquarters

Section C is to study the satisfaction degree of respondents on assets or facilities of SSL Headquarters. Respondents' satisfaction can directly reflect whether the assets or facilities of the SSL Headquarters are defective. According to Nafrizon et al. (2020), customer satisfaction is important for the assessment of features or uniqueness of assets or facilities. Therefore, Table 4.16 at the next page shows satisfaction degree of respondents on assets or facilities of SSL Headquarters which use the perspective of respondents towards the problem of assets or facilities. This satisfaction list was ranked based on index mean calculation method where 1.00 to 3.99 for "Frequent Happen" the problem on assets or facilities, 4.00 to 7.99 for "Neutral" and 8.00 to 10.00 for "Less Happen" the problem on assets or facilities. Finally, the researcher categorized listed item into two groups namely "Major Defect" factor and "Minor Defect" factor. These two groups also used the index mean scale method to categorize from 1.00 to 4.99 for "Major Defect" and 5.00 to 10.00 for "Minor Defect".

Table 4.16: Satisfaction degree of respondents on assets or facilities of SSL Headquarters

No	Items	Frequency Rank										Total Score	Index Mean	Rank	Category Group
		1	2	3	4	5	6	7	8	9	10				
1	Mechanical system (including elevator, air-conditioning, fire fighting system, generator, plant room operation etc.)	0	0	0	0	7	10	15	13	23	15	661	7.96	**4**	**Minor Defect**
2	Electrical system (including lighting system, CCTV, electrical wiring etc.)	0	3	4	4	5	12	11	27	17	0	577	6.95	**2**	**Minor Defect**
3	Plumbing system (including plumbing leaks, sanitary appliances etc.)	0	0	1	0	2	2	5	15	20	38	740	8.81	**6**	**Minor Defect**
4	Architectural system (including wall surface cracking, floor tiles defect, ceiling damaged etc.).	0	0	2	10	15	13	23	10	10	0	530	6.39	**1**	**Minor Defect**
5	Pest control service (including flies, cockroaches, rats etc.)	0	0	0	0	0	0	1	5	22	55	795	9.58	**8**	**Minor Defect**
6	Housekeeping works (including cleaning works, cleaning of rubbish bin etc.)	0	0	0	0	0	1	0	3	19	60	801	9.65	**9**	**Minor Defect**
7	Ground keeping works (including landscape and potted plants)	0	0	0	0	0	5	8	23	14	33	726	8.75	**5**	**Minor Defect**
8	Parking services (including not enough car park, discoloration of car park line marking etc.)	0	0	0	0	3	1	2	19	20	38	747	9.0	**7**	**Minor Defect**
9	Interior and exterior wall painting finishes (including discolouration, efflorescence, chalking etc.).	0	1	1	3	0	17	29	25	7	0	585	7.05	**3**	**Minor Defect**

Sample calculation:-

Index mean can be calculated as shown in below:-

$$\text{Mechanical system} = \frac{\sum x}{n}$$

$$= \frac{Number\ of\ respondents\ X\ Result\ of\ respondents}{Number\ of\ responents}$$

$$= \frac{(1 \times 0) + (2 \times 0) + (3 \times 0) + (4 \times 0) + (5 \times 7) + (6 \times 10) + (7 \times 15) + (8 \times 13) + (9 \times 23) + (10 \times 15)}{83}$$

$$= \frac{661}{83}$$

$$= \mathbf{7.96}$$

According to Naoum (2007), a scale of two categories has been used for the average index method in order to show priority. The scales of two categories are major factors and minor factors as shown below:-

Major Defect = 1.00 to 4.99
Minor Defect = 5.00 to 10.00

Through the Table 4.16, it shows that there is no major defect at SSL Headquarters in accordance to the category group instead only minor defect indeed. Also, Figure 4.16 is the bar chart to demonstrate the rank of satisfaction degrees on assets or facilities of SSL Headquarters which can be easily for compared and referenced. According to Table 4.16 and Figure 4.16, Architectural system is the first rank among other items or minor defect category group which is represent by index mean of 6.39. It can be concluded that most of minor defect is due to the wall surface cracking, floor tiles defect, ceiling damaged and so on. It can also be evidenced by the observation of researcher at the scene with the photos as shown in Figure 4.17. The researcher thinks this minor defect happened may be SSL Headquarters is out of budge in maintaining this minor defect through semi-structured interview with two officers of maintenance department.

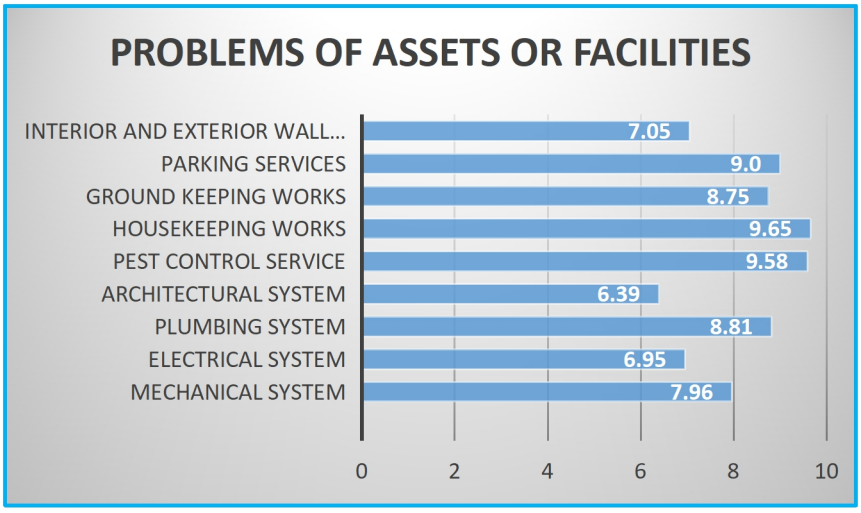

Figure 4.16: Percentage difference for problems that happen on assets or facilities

Figure 4.17: Four pieces of photos for architectural system minor defect

The second rank of unsatisfied of the respondents towards minor defect is electrical system which accounted for 6.95 of index mean. This electrical system normally includes but not limited to lighting system, closed-circuit television (CCTV), electrical wring, electrical socket, and such. It can be evidenced by the photos as shown in Figure 4.18. The electrical system

becomes second rank is may be also out of budget or financial problem in maintenance cost due to it categorized as minor defect and the SSL Headquarters may think better allocate the maintenance cost to other urgent major defect.

Figure 4.18: Minor defect of electrical system like lighting system breakdown and electrical socket failure as attached photos

Apart from that, interior and exterior wall painting finishes are regarded as the third rank with the index mean of 7.05. This wall painting finishes refer to discolouration, efflorescence, chalking and so on as shown in Figure 4.19 as an evidence taken from the site observation. It can be concluded that the interior wall painting has not been repainted because it involved out of budget or financial problem as well. The researcher draw this conclusion is because the answer obtained from the semi-structured interview with maintenance department which would be explained in the following subtopic.

Figure 4.19: Minor defect of interior wall painting finishes

The next satisfaction degree on assets or facilities of SSL Headquarters are followed by the mechanical system with index mean of 7.96, ground keeping works with index mean of 8.75, plumbing system with index mean of 8.81, parking services with index mean of 9.0, pest control service with index mean of 9.58 and housekeeping works with index mean of 9.65. Overall, all of these minor defect also related to out of budget or financial problems that would be explained in the following subtopic of semi-structured interview.

4.3 Results of Semi-Structured Interview

The objective of this interview been carried out is to gain clearer information, in-depth understanding, and to determine the actual operation of SSL Headquarters in handling maintenance works. This interview was done on two officers namely one of them is a maintenance head and the other one is the technician of SSL headquarters. The results and discussion of the interview are shown as follows:-

1)What types of maintenance normally being adopted at SSL Headquarters?

According to the interviewees, planned maintenance is being applied at SSL Headquarters instead of unplanned maintenance. But, it have to depend on which kind of assets should be maintained or more specifically need to depend on the condition of the assets. Take an example, the lighting system is applied to unplanned maintenance approach, there would be no any maintenance approach to be used. Put it simply, the bulb of the lighting system bulb will be replaced once it has breakdown. Both of them consensus that it's a cost-effective method to avoid unnecessary wastage in such little matter. Therefore, it can be concluded that planned maintenance only adopted on certain valuable assets. It included but not limited to AHU, elevator, generator machine, and so on.

2)Which of the maintenance approaches do you use under planned maintenance?

One of the interviewees who is the head of maintenance department replied that we are currently used preventive maintenance approach in the organization. While we are still applied other maintenance approach as the combination strategy to maintain the assets of SSL Headquarters. For instance, routine maintenance is being used as the maintenance of daily cleaning in the organization. This maintenance action is in line in statement of Ungureanu et

al., (2017) who stated that it is possible the use of different maintenance approaches, simultaneous, in a single enterprise, in order to get the full benefits of different maintenance approaches.

3)Does the SSL Headquarters use the computerized maintenance management system (CMMS)?

The head department of maintenance answered that there is no application of any software in maintenance management practices at SSL Headquarters. Only used conventional paper-based method as a recording purpose. But, software like Microsoft Excel or Word also is applied for some recording purpose.

4)How often is maintenance inspection or evaluation done on SSL Headquarters assets?

Usually, the maintenance inspection or evaluation will be carried out once a year based on the response of two interviewees. But except the lighting system would not perform maintenance inspection or evaluation as explained previously. Every year public works department (PWD) will come to visit the building of SSL Headquarters as well as to carry out inspection or evaluation of maintenance. Therefore, it can be known that the maintenance work is under the authority of PWD even though there is maintenance department at the SSL Headquarters. Maintenance department of SSL Headquarters only responsible to do the strategic maintenance planning for the building of SSL Headquarters and the rest library branches around Sabah state.

5)Does the SSL Headquarters have maintenance procedure?

The head department stated that SSL Headquarters have maintenance procedure that should be followed when carrying out maintenance work. She added that the objectives of the maintenance procedure is to provide guidelines and measures for the maintenance of buildings, departmental vehicles, and other facilities in order to be carried out efficiently as well as to comply with the rules set by the SSL management to ensure it is always in good condition and operational (appendix C). We have 5 types of maintenance procedure for specific asset at SSL Headquarters namely building maintenance, departmental vehicle maintenance, generator maintenance, air conditioning maintenance, and elevator maintenance

(appendix C). Each type of maintenance procedure has its own flow chart for easy reference and follow as shown in appendix D.

6)Would you mind to tell me about the annual maintenance budget?

According to the head of maintenance department, the actual figure cannot expose to the researcher due to it involved privacy and confidential reason. But she added that the budget of the SSL Headquarters a bit tight. For example, an exterior wall repainting works were done on last year which has caused the maintenance works for other assets have to hold for the being time. By doing so, it could keep the fund for other emergency maintenance purpose in the event of failure of asset occurs at the same year.

7)How is the maintenance work being carried out?

According to the head of maintenance department, the maintenance outsourcing method is applied in SSL Headquarters. Generally, the quotation will be requested from the relevant contractor for an asset that need to be maintained. Should the quotation price is above Rm20,000, SSL Headquarters have to seek approval from the PWD (maintenance procedure as shown in appendix C). The PWD has the final decision on the quotation price above Rm20,000. Conversely, for the price below Rm20,000 SSL Headquarters can make decision by themselves.

8)How long do you solve the complaint of the facilities' user?

The head department of maintenance stated that the complaint boxes will check by appointed technician the next day. Then, the technician will study the complaint form. Usually, it needs to take 1 or 2 days to settle the complaint for minor breakdown. But, it must depend on the types of asset or facility complained of. For example, if the elevator breakdown occur, it's impossible can solve immediately. And, it also need to depend on what's wrong with the elevator. It is difficult to state out the actual period but will solve it as soon as possible. Therefore, it can be concluded the maintenance department will resolve the complaint without any delay and as soon as possible.

CHAPTER 5

CONCLUSION

5.1 Introduction

Recommendation for Future Research limitation of the study

This is a final chapter of this research that has been conducted on the effectiveness of maintenance management at SSL Headquarters. This chapter is divided into three parts, in which the first part is present the conclusion based on the findings of the study in relation to the objectives of this research and recommendations are provided for continuous improvement. While the second part is the recommendations for future research to those who want to study the research of current maintenance management in any organization. The third part is the limitation of the study which explain the difficulties that have faced by the researcher. Last but not least, this research can also be used as a reference for future study purpose in terms of idea sharing that related on maintenance services.

5.2 Conclusion: Evaluating the Findings of the Study

Conclusions can be drawn based on the result of discussion in chapter 4 to answer the objectives of the research. All the results obtained are based on the distributed questionnaire. Also, semi-structured interview with two officers of maintenance department can aid to understanding the effectiveness of maintenance management at SSL Headquarter and added value to this whole research. Therefore, the conclusions of the research objectives are described as follow:-

5.2.1 Research Objective 1: To Study the Effectiveness of Current Maintenance Management Practices at SSL Headquarters

By referring on the result obtained for the percentage of facilities service satisfaction level as shown in Figure 4.6, it can be concluded that most of respondents support the effectiveness of current maintenance maintenance practices at SSL Headquarters. According to the result in Figure 4.6, most of respondents that are 61.4% out of 100% choose strongly agree and agree which are accounted for 32.5% and 28.9% respectively. And, it also supported by the percentage of arrangement properly of maintenance services, condition of facilities at SSL Headquarters, maintenance of drainage system, and cleaning condition of SSL Headquarters as shown in Figure 4.8, Figure 4.10, Figure 4.12, and Figure 4.13. They all gave the positive point of view and highly praised towards the effectiveness of current maintenance maintenance practices at SSL Headquarters. Furthermore, the results of Table 4.16 also fully support the effectiveness of current maintenance management practices at SSL Headquarters where there are no any major defects occur while only minor defects.

Besides that, through the secondary source that is the semi-structured interview can directly proved the maintenance management practices of SSL Headquarters is effective. This is because SSL Headquarters is well planned in maintenance activities including implementing planned maintenance with combination of other maintenance approaches, once a year to do maintenance inspection on assets, a systematic maintenance procedure, and solve the complaint of users at once.

5.2.2 Research Objective 2: To Identify the Defects of Assets at SSL Headquarters

Actually, the objective 2 of this research is to identify the defects of assets or facilities at SSL Headquarters but there are no defects discovered. Put it simply, there are only minor affected defects discovered in this study. It can be proved by the results based on the calculation of average index that has been made via data collection from the questionnaire as shown in Table 4.16 or Figure 4.16. From this average index calculation method, all the assets or facilities in the listing Table would have been categorized into two groups namely major affected defects and minor affected defects. Due to there were no major affected defects in the Table 4.16 or Figure 4.16, it can be concluded that no major defects discovered at SSL Headquarters and only minor one. For the ranking of minor affected defects are architectural

system, electrical system, interior and exterior wall painting finishes, mechanical system, ground keeping works, plumbing system, parking services, pest control services, and housekeeping works. However, the objective 1 of the research and Figure 4.6 or Table 4.6 have been verified that the assets or facilities of SSL Headquarters have highly percentage of satisfaction level in total. Without a doubt, the assets or facilities at SSL headquarters are well taken care of and there are no any major defects.

Furthermore, it can also supported by the semi-structured interview with the maintenance department. Through semi-structured interview, it can be known that the assets or facilities of SSL Headquarters are not categorized into major defects group because maintenance department take immediate maintenance action to repair assets' or facilities' breakdown when they are received the complaint from the users to prevent the assets or facilities getting worse. This is supported by the statement of Muthusamy (2015) who stated that if left unattended, it can develop into major problems leading all the way to total failures. While Rahmat et al. (2016) expressed that maintenance action may help to minimise the deterioration risks of defects and failures in the building.

5.2.3 Research Objective 3: To Propose Recommendations for Continuous Improvement

Even though no major defects on assets or facilities of SSL Headquarters, but there are still have a room for continuous improvement (CI). The following are the recommendations for CI of the assets or facilities at SSL Headquarters:-

1) The maintenance department should utilize computerized system or effective software system like computerized maintenance management system (CMMS) to manage the maintenance of building facilities or assets rather than unsystematic and paper-based databases such as Microsoft Excel and Microsoft Word. According to Ismail and Kasim (2013), the significant factor to select a CMMS is much more advantageous than just a way to schedule maintenance management processes and able to perform the task needed without stressing the budget. They added that the new system of CMMS is equipped with the decision making process for maintenance identification, assessing and planning activity. Therefore, CMMS

apply to the SSL Headquarters can increase the efficiency of the maintenance management processes.

2)The maintenance budget should be increased in order to avoid uncertainty factors happen which could lead to maintenance costs are overrun. This may result in lack of maintenance care for other assets or facilities because of the financial issues. Due to slow and deferment of upkeep for the assets or facilities may cause the minor defects factor to be major factor and accelerate the deterioration of the assets or facilities. Many assets or facilities reach the end of their useful life before they become unserviceable (Mat & Baharum, 2015). Ali et al. (2010) agreed that maintenance costs cover the overall cost or budget, which is allocated to keep the assets or facilities to the best performance, or to retain the assets or facilities in good condition.

3)To improve and review the existing maintenance procedure of maintenance department every year so that the maintenance process is more comprehensive and efficient. Due to this improvement and reviewing of procedure can aid to keep the maintenance department up to date with regulations, technology, and industry best practice. It can also help to to determine whether the targets have been achieved, and to find out what can be done to solve the remaining problems that have occurred (Husaini & Tabassi, 2014). Besides, update the maintenance procedure should include any new knowledge or lessons learned from the solution, and explain exactly how to carry out the task (Muthusamy, 2015).

4)To provide appropriate training course to employees in maintenance department. It can increase the knowledge and skills of employees in maintenance department as the current technology, materials, or even equipment are more state-of-the-art and complex. Nishtha and Amit (2010 as cited in Nda & Fard, 2013) also agreed that the skills and knowledge of employees have to be replenished because the skills and knowledge erode and become obsolete over a period of time. Also, the training course provides the most effective ways to eliminate or avoid accidents by training people to do tasks correctly (Muthusamy, 2015).

5)Maintenance department should application of activity board in monitoring the progress of ongoing maintenance task. It can remind and motivate the employees who undertake the maintenance task. According to Muthusamy (2015), activity board can help the maintenance personnel to understand what problems remain and helps promote cooperation among maintenance employees.

5.3 Recommendation for Future Research

Due to this research is completed in a limited amount of time, there is a room of improvement for future research on maintenance management practices either in public or private building. So, some recommendations are put forward for future research as follows:-

1)Comparative study on effectiveness of maintenance management practices between government building and private building. By looking at the differences in maintenance management practices between these two sectors can gain insight into the differences in the maintenance approaches they use. Besides, it can also let us know which sectors are more concerned on maintenance management practices.

2)Study the importance of cost on maintenance management practices in building. It can help to determine the target cost limit required for maintenance activities on assets of building. Also, it can find out the maximum benefit with the smallest cost investment on assets of building.

3)Investigate the effectiveness of computerized system to manage the maintenance activities on assets of building. Through this study can know the differences in between conventional based maintenance method and computerized maintenance management system (CMMS).

5.4 Limitation of the Study

There was an inevitable constraints and difficulties faced by the researcher while conducted this study. Firstly, the time constraints are one of the limitations in carrying this study because the researcher should allocate time appropriately as best as possible in gathering information from the SSL Headquarters. Also, the researcher should conduct the questionnaire in a timely manner to avoid wastage of time that could cause delays in completing the study.

Next, the researcher was difficult to obtain relevant sources in relation to the assets or facilities of library due to lack of relevant references. The main reason is because no such study was made and relevant book as a specific reference. This problem has led the researcher forced to refer to the literature reviews related to the maintenance of university building.

Last but not least, the first appointment with the head department of maintenance has prevented the researcher from obtaining any information. This is because all the information requested by researcher is private and confidential document, and information. The researcher have to get second time approval from the director of SSL Headquarters for the information requested. Finally, the director of SSL Headquarters has approved the permission for obtaining the information requested.

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APPENDICES

Appendix A

List of Facilities And Services At SSL Headquarters

Level	Facilities and Services
1	➢ Library network division (Despatch). ➢ State depository division. ➢ Catalog division.
2	➢ Magazine collection. ➢ General reading area. ➢ Internet corner. ➢ Information technology support division. ➢ Reader's service division.
3	➢ Banggi meeting room. ➢ Library information system division. ➢ Information and reference services division. ➢ Corporate and media division.
4	➢ Hypermedia collection. ➢ Tagunggak room. ➢ Sompotom room.
5	➢ Malaysiana collection. ➢ Government publication collection. ➢ Turali room. ➢ Gabang room. ➢ Tombol room.
6	➢ Electronic resources division. ➢ Sabah heritage collection. ➢ State depository room. ➢ Gambus room. ➢ Tongkungon room.
7	➢ National depository collection. ➢ Kulintangan room. ➢ Gandang room.
8	➢ Office of headquarters.

Appendix B

Questionnaire Form (Page 1/7)

OPEN UNIVERSITY MALAYSIA

QUESTIONNAIRE SURVEY ON MAINTENANCE MANAGEMENT PRACTICES AT SABAH STATE LIBRARY HEADQUARTERS

Final Year Project for Bachelor of Science in Project and Facility Management with Honours,
Faculty of Science and Technology,
Open University Malaysia (OUM).

Conducted by:
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THIS SURVEY IS FOR ACADEMIC PURPOSE ONLY.
ALL INFORMATION WILL BE KEPT CONFIDENTIAL.

THIS QUESTIONNAIRE CONTAINS OF THREE SECTIONS IN SEVEN PAGES INCLUDE THIS PAGE. PLEASE ANSWER ALL QUESTIONS.

Appendix B

Questionnaire Form (Page 2/7)

SECTION A (DEMOGRAPHY)
BAHAGIAN A (DEMOGRAFI)

This section consists of personal information and contact details.
Bahagian ini mengandungi maklumat peribadi dan butiran kenalan.

1. Gender (Jantina) :
2. Age (Umur) :
3. What is your academic background? (Apakah latar belakang akademik anda?)

☐	Master/PhD (Sarjana/PhD)	☐	Certificate (Sijil)
☐	Degree (Ijazah)	☐	SPM (SPM)
☐	Diploma (Diploma)	☐	Uneducated (Tidak Berpendidikan)

4. What is your position at Sabah State Library Headquarters? (Apa kedudukan anda di Ibu Pejabat Perpustakaan Negeri Sabah?)

☐	Management Level (Tahap Pengurusan)
☐	General Staff (Pekerja Am)
☐	Visitor (Pelawat)

5. How many years are you working at Library? No is for visitors (Berapa tahun anda bekerja di Perpustakaan? Tidak adalah untuk pelawat)

☐	No (Tidak)	☐	6 to 10 years (6 hingga 10 tahun)
☐	Less than 3 years (Kurang dari 3 tahun)	☐	Above than 10 years (Melebihi 10 tahun)
☐	3 to 6 years (3 hingga 6 tahun)		

Questionnaire Form (Page 3/7)

SECTION B (PERSPECTIVE OF RESPONDENT ON EFFECTIVENESS OF MAINTENANCE SERVICES AT SABAH STATE LIBRARY HEADQUARTERS.)

BAHAGIAN B (PERSPEKTIF RESPONDEN TERHADAP KEBERKESANAN PERKHIDMATAN PENYELENGGARAAN DI IBU PENJABAT PERPUSTAKAAN NEGERI SABAH.)

1)Do you agree that the facilities service provided by SSL Headquarters are satisfactory?

Adakah anda bersetuju bahawa perhidmatan kemudahan yang disediakan oleh Ibu Pejabat SSL adalah memuaskan?

Strongly Disagree Sangat Tidak Setuju	Disagree Tidak Setuju	Neutral Terkecuali	Agree Setuju	Strongly Agree Sangat Setuju

2)Do you agree that maintenance services play the important role at SSL headquarters?

Adakah anda bersetuju bahawa perkhidmatan penyelenggaraan memainkan peranan penting di ibu pejabat SSL?

Strongly Agree Sangat Setuju	Agree Setuju	Neutral Terkecuali	Disagree Tidak Setuju	Strongly Disagree Sangat Tidak Setuju

3)Do you agree that maintenance services arranged properly at SSL Headquarters?

Adakah anda bersetuju bahawa perkhidmatan penyelenggaraan diatur dengan betul di Ibu Pejabat SSL?

Slightly Agree Sedikit Setuju	Fairly Agree Sangat Setuju	Agree Setuju	Fairly Disagree Tidak Setuju	Slightly Disagree Sedikit Tidak Setuju

Questionnaire Form (Page 4/7)

4)Do you agree that maintenance services at SSL Headquarters should be improved?

Adakah anda bersetuju bahawa perkhidmatan penyelenggaraan di Ibu Pejabat SSL harus ditingkatkan?

Strongly Agree Sangat Setuju	Agree Setuju	Neutral Terkecuali	Disagree Tidak Setuju	Strongly Disagree Sangat Tidak Setuju

5)Do you agree that the condition of facilities failure often occur at SSL Headquarters? (E.g. roof leaking, plumbing leaking, breakdown of AHU, etc.).

Adakah anda bersetuju bahawa keadaan kegagalan kemudahan sering berlaku di Ibu Pejabat SSL? (Cth kebocoran atap, kebocoran paip, kerosakan AHU, dll.)

Strongly Agree Sangat Setuju	Agree Setuju	Neutral Terkecuali	Disagree Tidak Setuju	Strongly Disagree Sangat Tidak Setuju

6)Do you agree that facilities of SSL Headquarters giving you safety risks?

Adakah anda bersetuju bahawa kemudahan Ibu Pejabat SSL memberi anda risiko keselamatan?

Strongly Agree Sangat Setuju	Agree Setuju	Neutral Terkecuali	Disagree Tidak Setuju	Strongly Disagree Sangat Tidak Setuju

7)Do you agree that the drainage system around the SSL Headquarters is well maintained and does not cause flooding?

Adakah anda bersetuju bahawa sistem saliran di sekitar Ibu Pejabat SSL dijaga dengan baik dan tidak menyebabkan banjir?

Strongly Agree Sangat Setuju	Agree Setuju	Neutral Terkecuali	Disagree Tidak Setuju	Strongly Disagree Sangat Tidak Setuju

Questionnaire Form (Page 5/7)

8)Do you agree that cleaning is often done at SSL Headquarters?

Adakah anda bersetuju bahawa pembersihan sering dilakukan dengan baik di Ibu Pejabat SSL?

Strongly Agree Sangat Setuju	Agree Setuju	Neutral Terkecuali	Disagree Tidak Setuju	Strongly Disagree Sangat Tidak Setuju

9)Do you agree that the maintenance of the interior and exterior of a building paint works is essential to keeping SSL Headquarters like new for longer?

Adakah anda bersetuju bahawa penyelenggaraan dalaman dan luaran kerja cat bangunan adalah mustahak untuk memastikan Ibu Pejabat SSL seperti baru lebih lama?

Strongly Agree Sangat Setuju	Agree Setuju	Neutral Terkecuali	Disagree Tidak Setuju	Strongly Disagree Sangat Tidak Setuju

10) Do you agree that the building service life of SSL Headquarters can be as long as 50 years?

Adakah anda bersetuju bahawa jangka hayat bangunan Ibu Pejabat SSL boleh berlangsung selama 50 tahun?

Strongly Agree Sangat Setuju	Agree Setuju	Neutral Terkecuali	Disagree Tidak Setuju	Strongly Disagree Sangat Tidak Setuju

Appendix B

Questionnaire Form (Page 6/7)

SECTION C (SATISFACTION DEGREE OF RESPONDENTS ON ASSETS OR FACILITIES OF SABAH STATE LIBRARY HEADQUARTERS)

BAHAGIAN C (TAHAP KEPUASAN RESPONDEN TERHADAP ASET ATAU KEMUDAHAN IBUPENJABAT PERPUSTAKAAN NEGERI SABAH)

Place the number 1 to 10 to assess the problems that frequently happened at library.

Letakkan nombor 1 hingga 10 untuk menilai masalah yang sering berlaku di perpustakaan.

Rating Scale Skala Penilaian									
Frequent Happen Kerap Berlaku →				Neutral Terkecuali			→ Less Happen Kurang Berlaku		
1	2	3	4	5	6	7	8	9	10

	List Of Problems That Happen On Assets Or Facilities of Library Senarai Masalah Yang Berlaku Pada Aset Atau Kemudahan Perpustakaan	Rating Number Nombor Penilaian
1.	Mechanical system (including elevator, air-conditioning, fire fighting system, generator, plant room operation etc.). Sistem mekanikal (termasuk lif, penyaman udara, sistem pemadam kebakaran, penjana, operasi bilik loji dll.).	
2.	Electrical system (including lighting system, cctv, electrical wiring etc.). Sistem elektrik (termasuk sistem pencahayaan, cctv, pendawaian elektrik dll.).	
3.	Plumbing system (including plumbing leaks, sanitary appliances etc.). Sistem paip (termasuk kebocoran paip, peralatan kebersihan dll.).	
4.	Architectural system (including wall surface cracking, floor tiles defect, ceiling damaged etc.). Sistem seni bina (termasuk keretakan permukaan dinding, kerosakan jubin lantai, siling rosak dll).	
5.	Pest control service (including flies, cockroaches, rats etc.).. Perkhidmatan kawalan perosak (termasuk ants, lipas, tikus dll.).	

Appendix B

Questionnaire Form (Page 7/7)

6.	Housekeeping works (including cleaning works, cleaning of rubbish bin etc.). Kerja-kerja pengemasan (termasuk kerja pembersihan, pembersihan tong sampah dalaman dll.).	
7.	Ground keeping (including landscape and potted plants). Pemeliharaan tanah (termasuk lanskap dan tanaman pasu).	
8.	Parking services (including not enough car park, discoloration of car park line marking etc.). Perkhidmatan tempat letak kereta (termasuk tempat letak kereta yang tidak mencukupi, perubahan warna cat tanda garis tempat letak kereta dll.).	
9.	Interior and exterior wall painting finish (including discolouration, efflorescence, chalking etc.). Kemasan cat dinding dalaman dan luaran (termasuk perubahan warna, efflorescence, berkapur dll.).	

–END OF QUESTIUONNAIRE–

Your feedback will be kept strictly confidential.
Thank you for your cooperation and participate in this research survey.

Appendix C

Maintenance Procedure Of SSL Headquarters (Page 1/7)

1.0 **OBJEKTIF**

Prosedur ini menyediakan garis panduan dan langkah-langkah bagi penyelenggaraan bangunan, kenderaan jabatan, kemudahan-kemudahan yang lain agar dapat dijalankan dengan cekap serta mematuhi peraturan yang telah ditetapkan oleh pengurusan Perpustakaan Negeri Sabah bagi memastikan ianya sentiasa dalam keadaan baik dan beroperasi.

2.0 **SKOP**

Prosedur ini digunapakai oleh pemilik proses di Unit Penyelenggaraan, Bahagian Khidmat Pengurusan dan Personel dan pegawai-pegawai yang berkenaan dalam mengendalikan kerja-kerja penyelenggaraan bangunan, kemudahan-kemudahan dan kenderaan di Ibu Pejabat PNS, Kota Kinabalu.

3.0 **RUJUKAN**

3.1 Manual Kualiti MK. PNS- 03
- Seksyen 4.2.4 - Kawalan Dokumen
- Seksyen 6.3 - Infrastruktur
- Seksyen 6.4 - Persekitaran Kerja

3.2 Arahan Perbendaharaan

3.3 Pekeliling Perbendaharaan berkenaan penyelenggaraan kemudahan-kemudahan jabatan

3.4 Panduan Am Pendaftaran Kontraktor Kerja Awam

4.0 **DEFINISI**

4.1	Penyelenggaraan	-	Bermaksud kerja-kerja yang berkaitan dengan penyelenggaraan kenderaan jabatan, perkhidmatan pemeliharaan dan pemuliharaan bangunan, perkhidmatan kawalan haiwan perosak, sistem pencegah kebakaran, penyelelenggaran penghawa dingin, penyelenggaraan lif, penyelenggaraan generator dan kerja-kerja pembaikan kerosakan peralatan pejabat.
4.2	Kontraktor	-	Kontraktor penyelenggaraan bangunan dan perkhidmatan yang dilantik oleh Pihak Kerajaan.
4.3	Syarikat	-	Angkatan Hebat dan syarikat-syarikat atau bengkel yang berdaftar dengan Angkatan Hebat untuk menyelenggara kenderaan jabatan.
4.4	Buku Log Kenderaan	-	Buku Log Kenderaan merupakan sebuah buku rekod kenderaan jabatan yang digunakan untuk merekod masa perjalanan setiap hari, jarak perjalanan, catatan perjalanan, penggunaan bahan api, pengesahan pengguna kenderaan dan semakan pegawai pemeriksa.

Maintenance Procedure Of SSL Headquarter (Page 2/7)

6.0 TUGAS DAN TANGGUNGJAWAB

TANGGUNG JAWAB	TINDAKAN
	6.1 PENYELENGGARAAN KEROSAKAN DI BANGUNAN IBU PEJABAT PNS
	6.1.1. PERMOHONAN PEMBAIKAN
N26/S17	6.1.1.1. Terima aduan daripada KB melalui e-mail, memo atau panggilan telefon dan seterusnya membuat pemeriksaan berhubung dengan aduan tersebut.
N26/S17/KP11	6.1.1.2. Periksa aduan kerosakan yang diterima. Menghubungi JKR atau pihak yang berkenaan jika perlu, bagi membuat penilaian dan anggaran kos pembaikan atau penyelengaraan.
N26/S17	6.1.1.3 Buat analisa laporan hasil daripada pemeriksaan yang telah dibuat. Mengemukakan cadangan pembaikan atau penyelenggaraan kepada N41 untuk nasihat dan arahan selanjutnya.
N26/S17	6.1.1.4 Semak baki peruntukan [Jika ada peruntukan , ambil tindakan seterusnya ikut tatcara di bawah , jika tidak ada peruntukan , KB akan dimaklumkan]
	6.1.2. TENTUKAN TATACARA PEMBAIKAN
KBKPP/N26/S17	**6.1.2.1 PEMBAIKAN BESAR** a] Peruntukan Negeri . i] Kos melebihi RM20,000 tetapi kurang daripada RM250,000.00 [Sebutharga] [Ikut tatacara sebutharga seperti dibawah] ii] RM 250,000.00 dan ke atas [Tender] [Ikut tatacara proses tender dan dikemukakan ke Kementerian Pembangunan Masyarakat dan Hal Ehwal Pengguna]
N26/S17	c] Kajian pasaran. Bagi kos yang dibawah RM 20,000.00 [BN] Dapatkan kajian pasaran sekurang-kurangnya 3/5 syarikat kontraktor .
N26/S17	6.1.2.2 Dapatkan kelulusan daripada PGH/N41 (beritahu kepada KB sama ada permohonan diluluskan/simpan dalam perhatian/ditolak)

Maintenance Procedure Of SSL Headquarter (Page 3/7)

	6.1.3. CARA PEMBAIKAN / PENYELENGGARAAN MELALUI SEBUTHARGA/ TENDER
N27 (AA2)	6.1.3.1 Sediakan siri sebutharga dari buku daftar sebutharga. Daftarkan sebutharga seperti berikut:- 1. Nombor sebutharga 2. Tajuk sebutharga 3. Tarikh tutup dan masa tutup
N27 (AA2)	6.1.3.2 Sediakan notis sebutharga untuk dipamerkan dipapan kenyataan, edar atau iklankan dalam surat khabar tempatan dan Laman sesawang SSL
N26/S17	6.1.3.3 Labelkan peti sebutharga dengan :- 1. Tajuk sebutharga 2. Nombor sebutharga 3. Tarikh dan masa tutup sebutharga
N27 (AA2)	6.1.3.4 Keluarkan notis/e-mail pemberitahuan mesyuarat Pembukaan sebutharga kepada JKPS Perpustakaan Negeri Sabah
JKPS	6.1.3.5 Buka sebutharga pada tarikh dan masa yang ditetapkan
JKPS	6.1.3.6 Tandatangan ringkas pada harga tawaran di muka surat pertama setiap borang sebutharga
N27 (AA2)	6.1.3.7 Sediakan Jadual Pembukaan Sebutharga (Lampiran B) dengan senaraikan setiap sebutharga yang diterima.
N27 (AA1)	6.1.3.8 Tetapkan tarikh dan masa mesyuarat sebutharga setelah berbincang dengan ahli-ahli JKS Perpustakaan Negeri Sabah
JKS	6.1.3.9 Buat keputusan dan memastikan syarikat / kontraktor yang yang dipilih memenuhi syarat –syarat keperluan bagi kerja-kerja penyelanggaraan / pembaikan berdasarkan penilaian spesifikasi seperti mempunyai sijil-sijil atau lesen yang diperlukan .
N27 (AA1)	6.1.3.10 Dapatkan tandatangan pengerusi dan ahli JKS Perpustakaan Negeri Sabah, serta sediakan minit mesyuarat JKS Perpustakaan Negeri Sabah.
N27 (AA2)	6.1.3.11 Sediakan surat tawaran kepada syarikat/ Kontraktor yang berjaya dan surat maklumat kepada syarikat /kontraktor yang tidak berjaya.

Maintenance Procedure Of SSL Headquarter (Page 4/7)

S17	**6.1.4 PENGELUARAN PKA** 6.1.4.1 Sediakan PKA dan serahkan salinan pertama kepada kontraktor / syarikat. (PKA perlu terlebih dahulu ditandatangani oleh pegawai yang diberi kuasa menandatangani tertakluk kepada nilai PKA tersebut)
N26/S17	**6.1.5 PELAKSANAAN KERJA PEMBAIKAN/PENYELANGGARAAN** 6.1.5.1 Memantau dan membuat pemeriksaan kerja-kerja pembaikan / penyelanggaraan dan membuat laporan sijil pengesahan siap kerja (Nilai RM20,000.00 ke atas) [BSS] berikut:- a. Jika tidak memenuhi spesifikasi, minta kontraktor buat pembaikan semula, b. Jika memenuhi spesifikasi, lengkapkan sijil siap kerja dan minta kontraktor tandatangan PKA
N26/S17	6.1.5.2 Terima Invois dan salinan PKA dari kontraktor setelah kerja pembaikan / peyelenggaraan dilakukan dengan sempurna dan memuaskan , pastikan jumlah pembayaran dalam PKA dan invios tidak bercangah
N04	6.1.5.3 Rekodkan dan hantar 'invoice' berserta dengan salinan PKA ke bahagian akaun untuk proses pembayaran seterusnya.
	6.1.6 PEMBAIKAN KECIL
S17	i. Mendapatkan barangan gantian di stor atau pembelian terus dari pembekal ,
S17	ii. Melakukan pembaikan ,
S17	iii. Merekod di dalam buku aduan kerosakan
R3	**6.2 PENYELENGGARAAN KENDERAAN JABATAN** **6.2.1 PERMOHONAN PEMBAIKAN / SERVIS KENDERAAN** 1. Periksa keadaan kenderaan (enjin, lampu, brek, minyak hitam, radiator, tayar dan lain-lain) sekerap yang boleh terutamanya sebelum kenderaan digunakan bagi sesuatu operasi.
R3	2. Laporkan kepada N41/N26/N22 (Pegawai Kenderaan) sekiranya berlaku kerosakan dan mengisi borang KEW.PA-9
N22	3. Pohon kelulusan daripada PGH/N41 melalui borang KEW.PA – 9, Menyemak jadual penyelenggaraan kenderaan serta menyediakan surat kepada JKR (rujuk lampiran 8.1).
R3	4. Bawa surat asal dan kenderaan ke JKR untuk kelulusan pembaikan.

Appendix C

Maintenance Procedure Of SSL Headquarter (Page 5/7)

	6.2.2. TATACARA PEMBAIKAN / SERVIS
R3	6.2.2.1 Hantar kenderaan ke JKR untuk diservis
S17	6.2.2.2 Sediakan PKA untuk ditandatangani oleh PGH/N41
R3	6.2.2.3 Hantar kenderaan ke bengkel yang disyorkan oleh JKR untuk pembaikan dan tandatangan PKA oleh Pengurus Bengkel
R3	6.2.2.2 Ambil dan periksa kenderaan samada servis/pembaikan telah dijalankan dengan baik, memaklumkan semula kepada JKR jika pembaikan/servis tidak memuaskan.
R3	6.2.2.3 Bawa semula kenderaan yang telah selesai di servis/dibaiki daripada Bengkel/JKR ke Pejabat dan melaporkan status pembaikan kenderaan kepada N22 Pegawai Kenderaan.
	6.2.3. KAEDAH BAYARAN
S17/N22	6.2.3.3. Terima Invois dan salinan PKA dari kontraktor setelah kerja pembaikan / peyelenggaraan dilakukan dengan sempurna dan memuaskan , pastikan jumlah pembayaran dalam PKA dan invios tidak bercangah
N04	6.2.3.3. Rekod dan hantar 'invoice' berserta dengan salinan PKA ke bahagian akaun untuk proses pembayaran seterusnya.
	6.2.4. PELAKSANAAN KERJA- KERJA PEMBAIKAN/ SERVIS (DISEWA DARI ANGKATAN HEBAT)
N22	6.2.4.1 Periksa keadaan kenderaan (enjin, lampu, brek, minyak hitam, radiator, tayar dan lain-lain) sekerap yang boleh terutamanya sebelum kenderaan digunakan bagi sesuatu operasi
R3	6.2.4.2 Lapor kepada N41/N26/N22 (Pegawai Kenderaan) sekiranya berlaku kerosakan dan mengisi borang KEW.PA-9

Appendix C

Maintenance Procedure Of SSL Headquarter (Page 6/7)

N22	6.2.4.3 Pohon kelulusan daripada PGH/N41 melalui borang KEW.PA – 9, Menyemak jadual penyelenggaraan kenderaan serta menyediakan surat kepada JKR (rujuk lampiran 8.1).
R3	6.2.4.4 Bawa kenderaan ke JKR untuk pemeriksaan/kelulusan pembaikan
	6.2.4.5 Keluarkan PKA untuk di tandatangani oleh Pengurus Bengkel
S17	6.2.4.6 Hantar kenderaan ke bengkel Angkatan Hebat atau syarikat yang berdaftar dengan Angkatan Hebat.
R3	6.2.4.7 Ambill kenderaan yang telah dibaiki dan membawa ke JKR bersama alat-alat yang rosak untuk pengesahan pembaikan yang telah dilakukan.
S17	6.2.4.8 Terima invois/tuntutan bayaran daripada bengkel dan menghantarnya ke Bahagian Akaun.
N04	6.2.4.9 Rekodkan dan hantar 'invoice' berserta dengan salinan PKA ke bahagian akaun untuk proses pembayaran seterusnya.
	6.3. PENYELENGARAAN GENSET
PGH/N41/N27	6.3.1. Lantik Syarikat yang berwibawa untuk penyelenggaraan secara berjadual
S17	6.3.2. Sediakan buku semakan penyelenggaraan berjadual (BKPP/BKU 41/ 01/00)
S17/KP11	6.3.3. Buat pemantauan semasa juruteknik membuat penyelenggaraan, pastikan penyelenggaraan mengikut speksifikasi yang ditetapkan seperti yang dinyatakan dalam BKPP/BKU 41/ 01/00 seperti berikut: i) Periksa minyak hitam dan minyak diesel ii) Peroksa Oil Filter dan Air Filter iii) Bersihkan kawasan Genset iv) Test run genset secara manual selama 5-10 minit
S17/KP11	6.3.4. Bawa buku penyelenggaran berjadual untuk ditandatangan oleh Juruteknik dan juga pemantau.
S17	6.3.5. Terima Invois daripada syarikat dan kepilkan salinan "agreement"
N04	6.3.6. Rekodkan dan hantar 'invoice' berserta dengan salinan "agreement" ke bahagian akaun untuk proses pembayaran seterusnya.

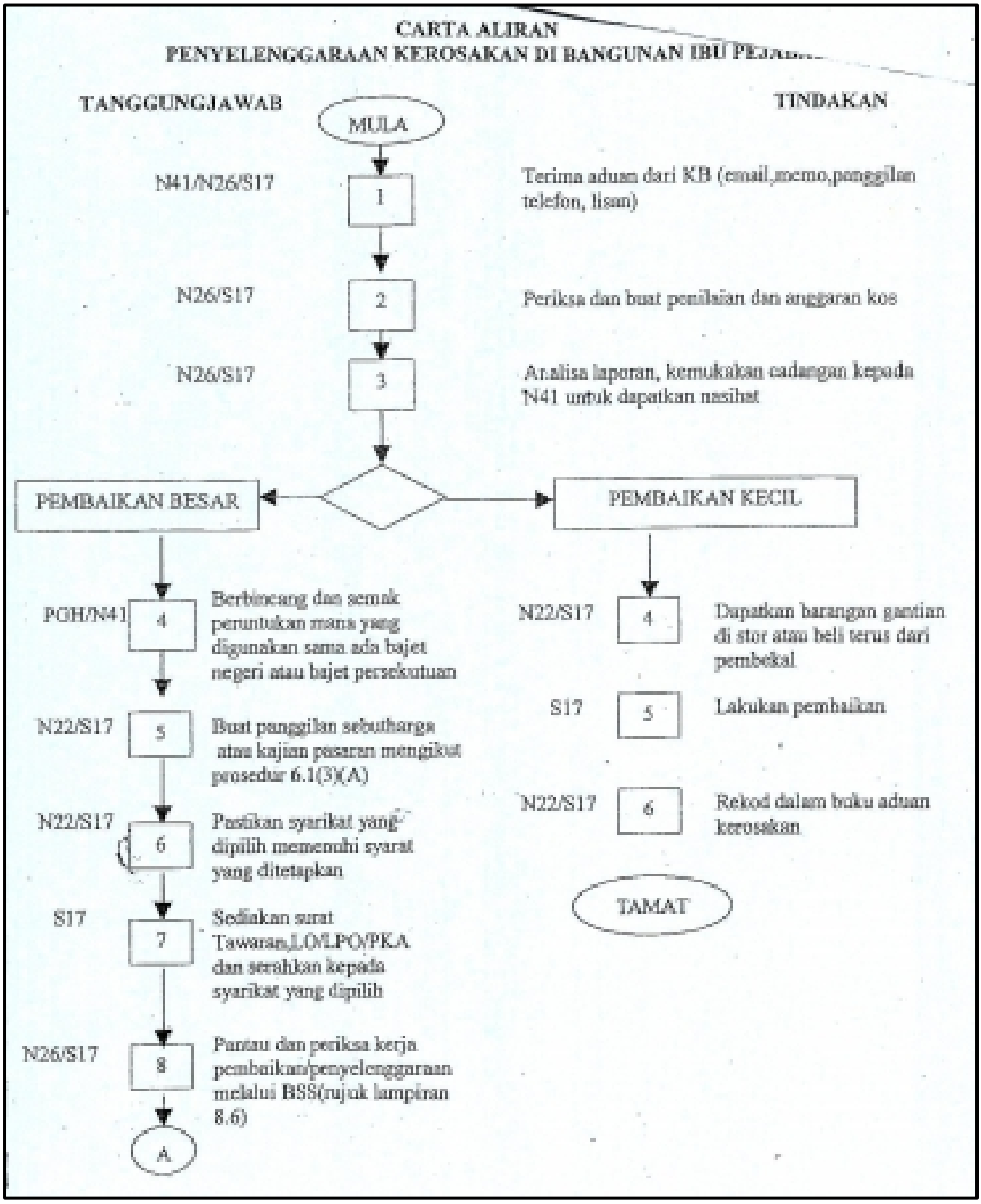
Appendix C

Maintenance Procedure Of SSL Headquarter (Page 7/7)

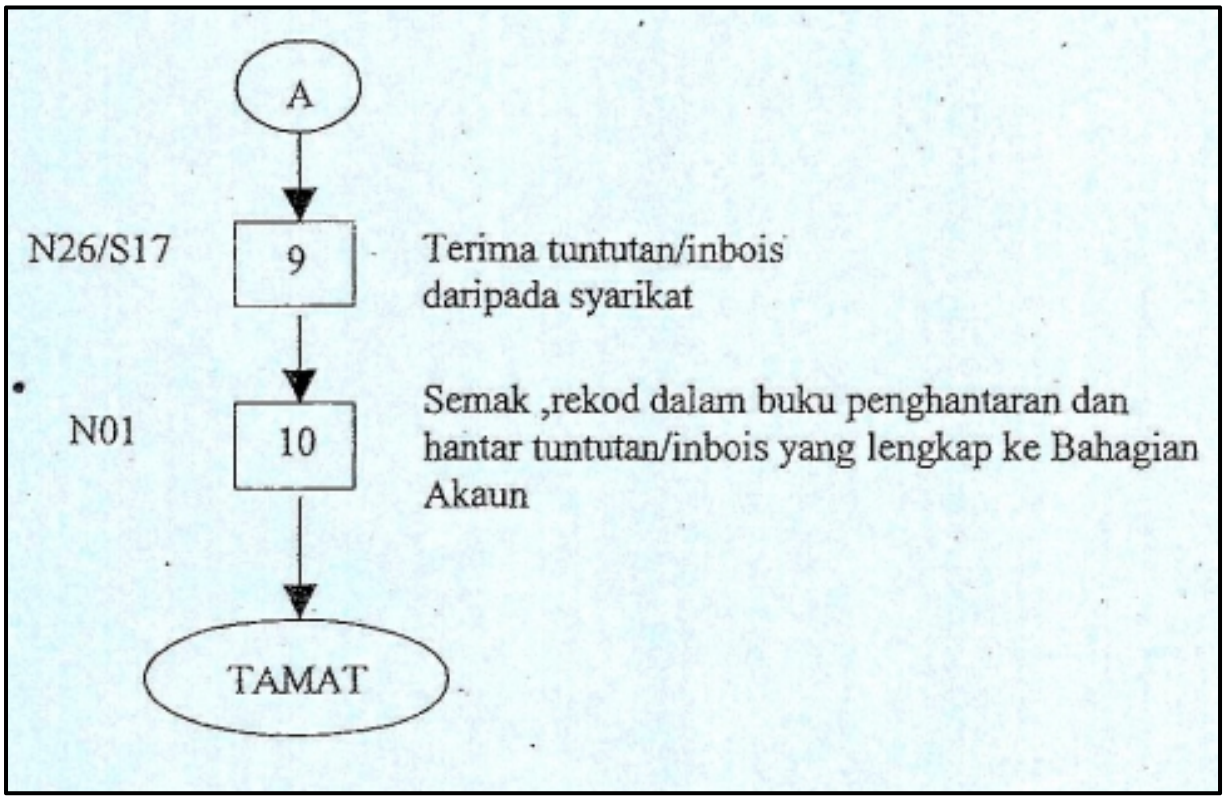
PGH/N41/N27	6.4. PENYELENGGARAAN PENGHAWA DINGIN 6.4.1. Lantik Syarikat yang berwibawa untuk penyelenggaraan secara berjadual (4 kali seahun)
S17	6.4.2. Sediakan buku semakan penyelenggaraan berjadual
S17/KP11	6.4.3. Buat pemantauan semasa juruteknik membuat penyelenggaraan, pastikan penyelenggaraan mengikut speksifikasi yang ditetapkan seperti yang dinyatakan dalam BKPP/BKU 41/ 01/00
S17/KP11	6.3.4. Bawa buku penyelenggaran berjadual untuk ditandatangan oleh Juruteknik dan juga pemantau.
S17	6.3.5. Terima Invois daripada syarikat dan kepilkaN salinan kontrak perjanjian
N04	6.3.6. Rekodkan dan hantar 'invoice' berserta dengan salinan kontrak perjanjian ke bahagian akaun untuk proses pembayaran seterusnya..
PGH/N41/N27	6.4. PENYELENGGARAAN LIFT 6.5.1. Lantik Syarikat yang berwibawa untuk penyelenggaraan secara berjadual (setiap bulan)
S17	6.5.2. Sediakan buku semakan penyelenggaraan berjadual
S17/KP11	6.5.3. Buat pemantauan semasa juruteknik membuat penyelenggaraan, pastikan penyelenggaraan mengikut speksifikasi yang ditetapkan seperti yang dinyatakan dalam BKPP/BKU 41/ 01/00
S17/KP11	6.5.4. Bawa buku penyelenggaran berjadual untuk ditandatangan oleh Juruteknik dan juga pemantau.
S17	6.5.5. Terima Invois daripada syarikat dan kepilkan salinan kontrak perjanjian
N04	6.5.6. Rekodkan dan hantar 'invoice' berserta dengan salinan kontrak perjanjian ke bahagian akaun untuk proses pembayaran seterusnya..

Appendix D

Flow Chart Of Maintenance Procedure Of SSL Headquarter 1

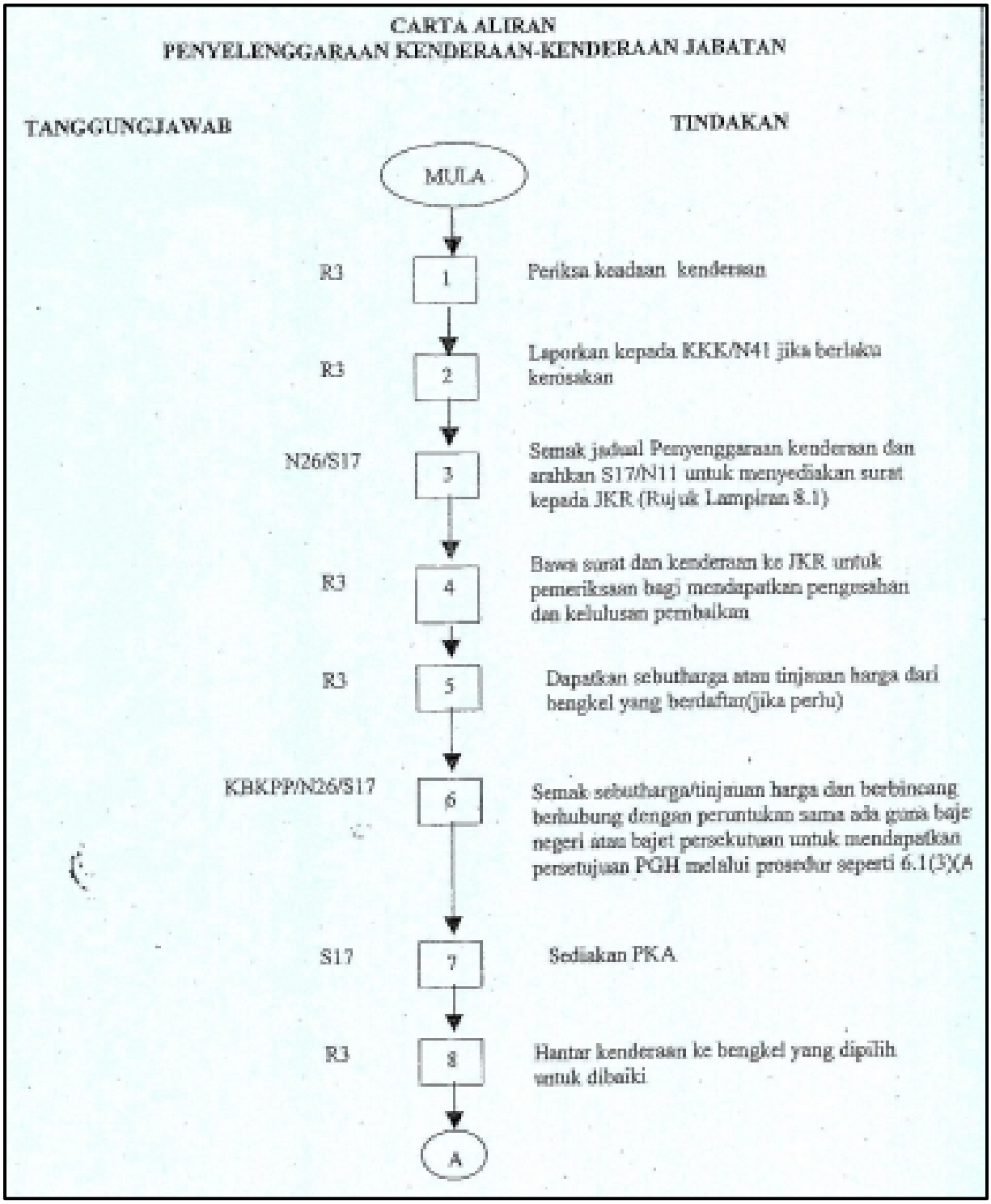


Appendix D

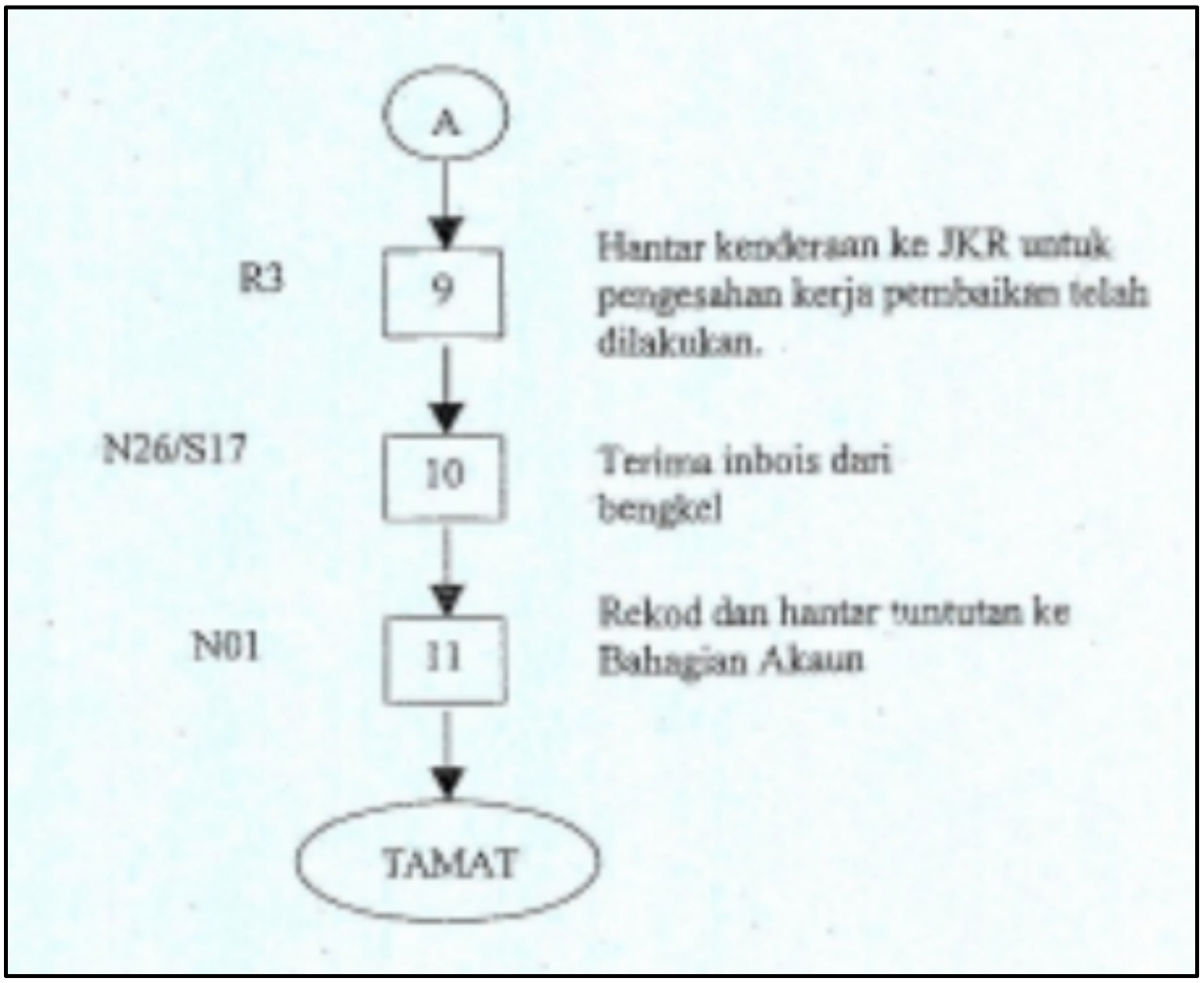

A
N26/S17
9
Terima tuntutan/inbois daripada syarikat
N01
10
Semak ,rekod dalam buku penghantaran dan hantar tuntutan/inbois yang lengkap ke Bahagian Akaun
TAMAT

Appendix D

Flow Chart Of Maintenance Procedure Of SSL Headquarter 2

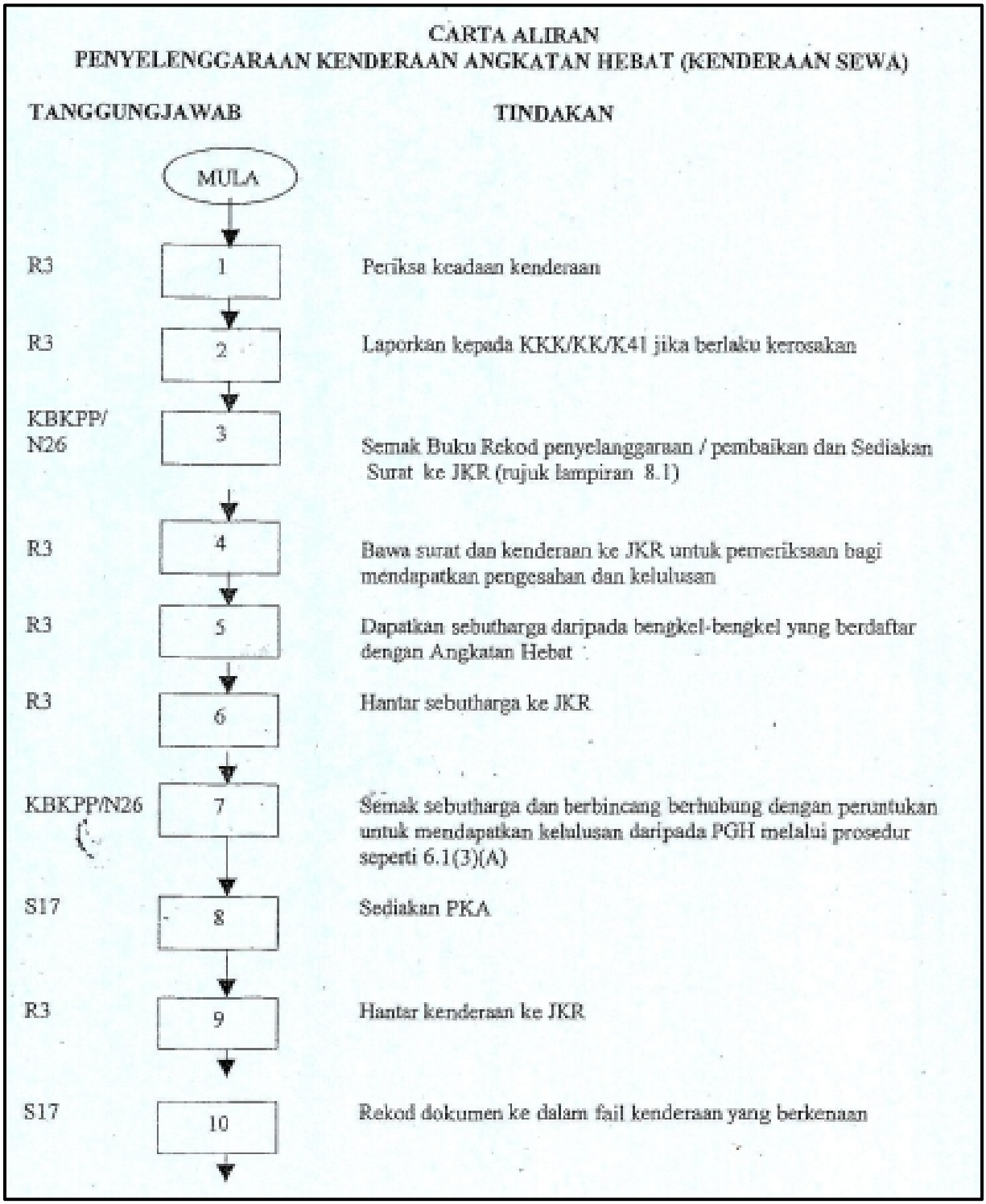


Appendix D


A
R3
9
Hantar kenderaan ke JKR untuk pengesahan kerja pembaikan telah dilakukan.
N26/S17
10
Terima inbois dari bengkel
N01
11
Rekod dan hantar tuntutan ke Bahagian Akaun
TAMAT

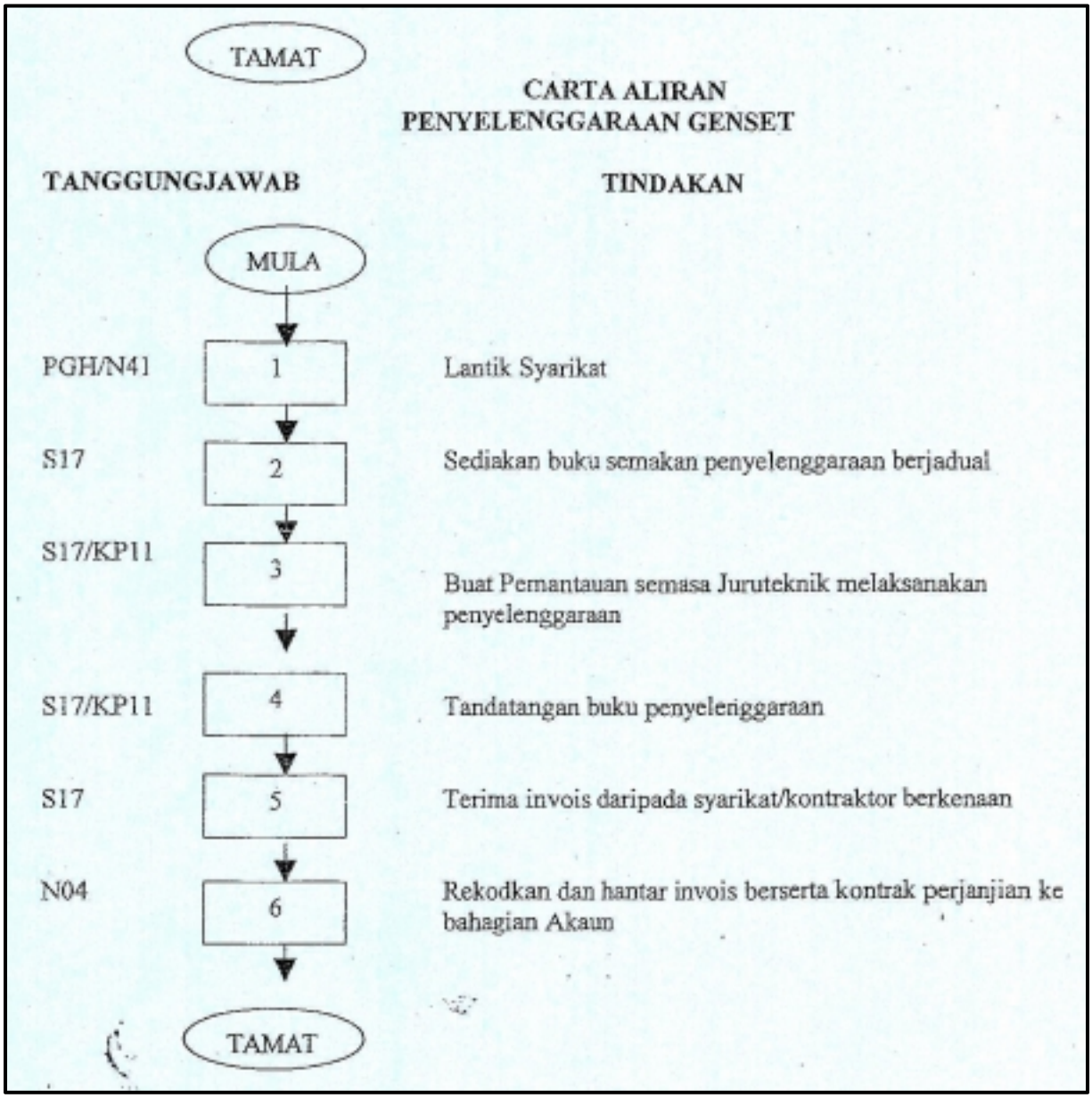
Appendix D

Flow Chart Of Maintenance Procedure Of SSL Headquarter 3



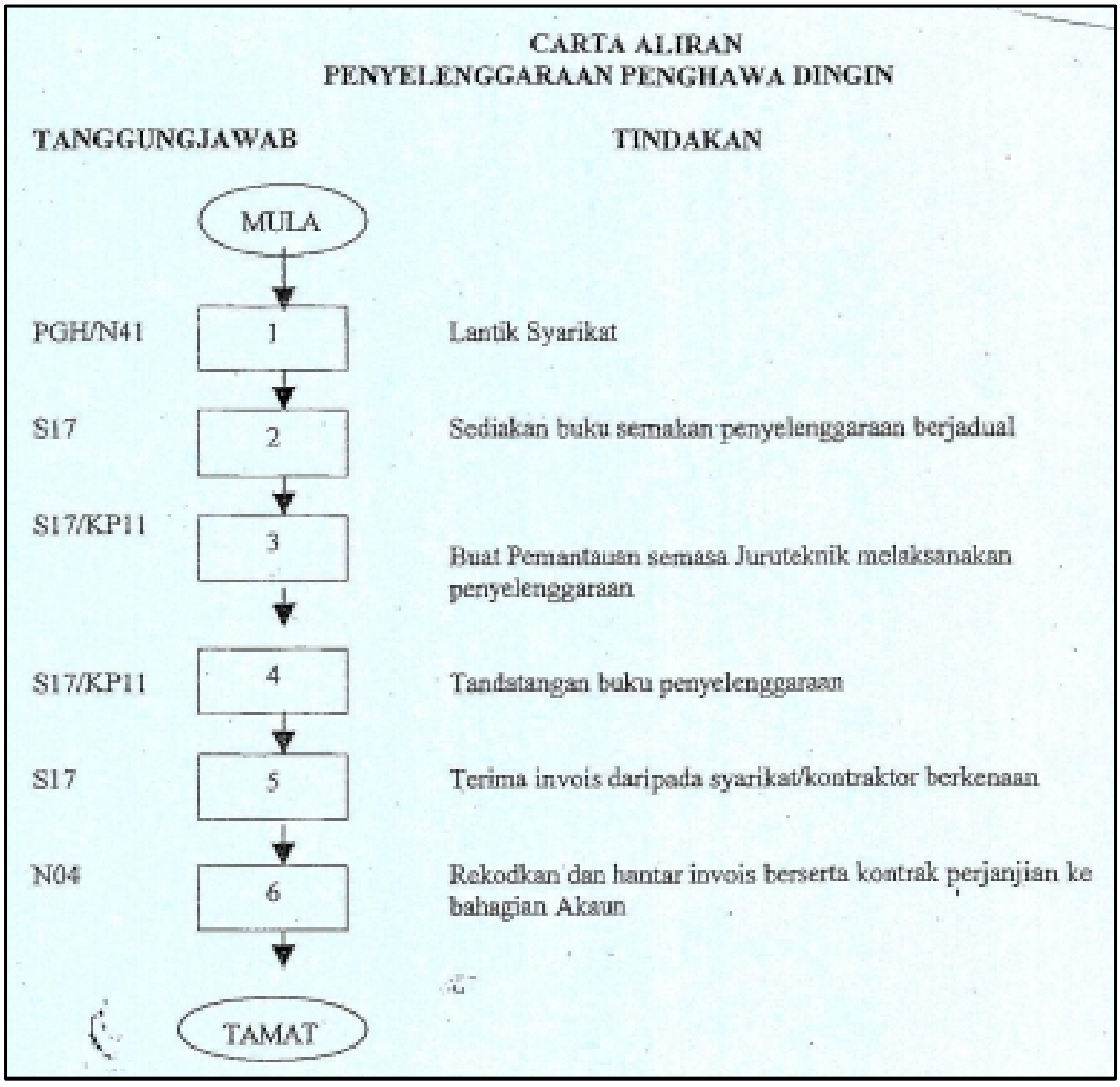
Appendix D

Flow Chart Of Maintenance Procedure Of SSL Headquarter 4



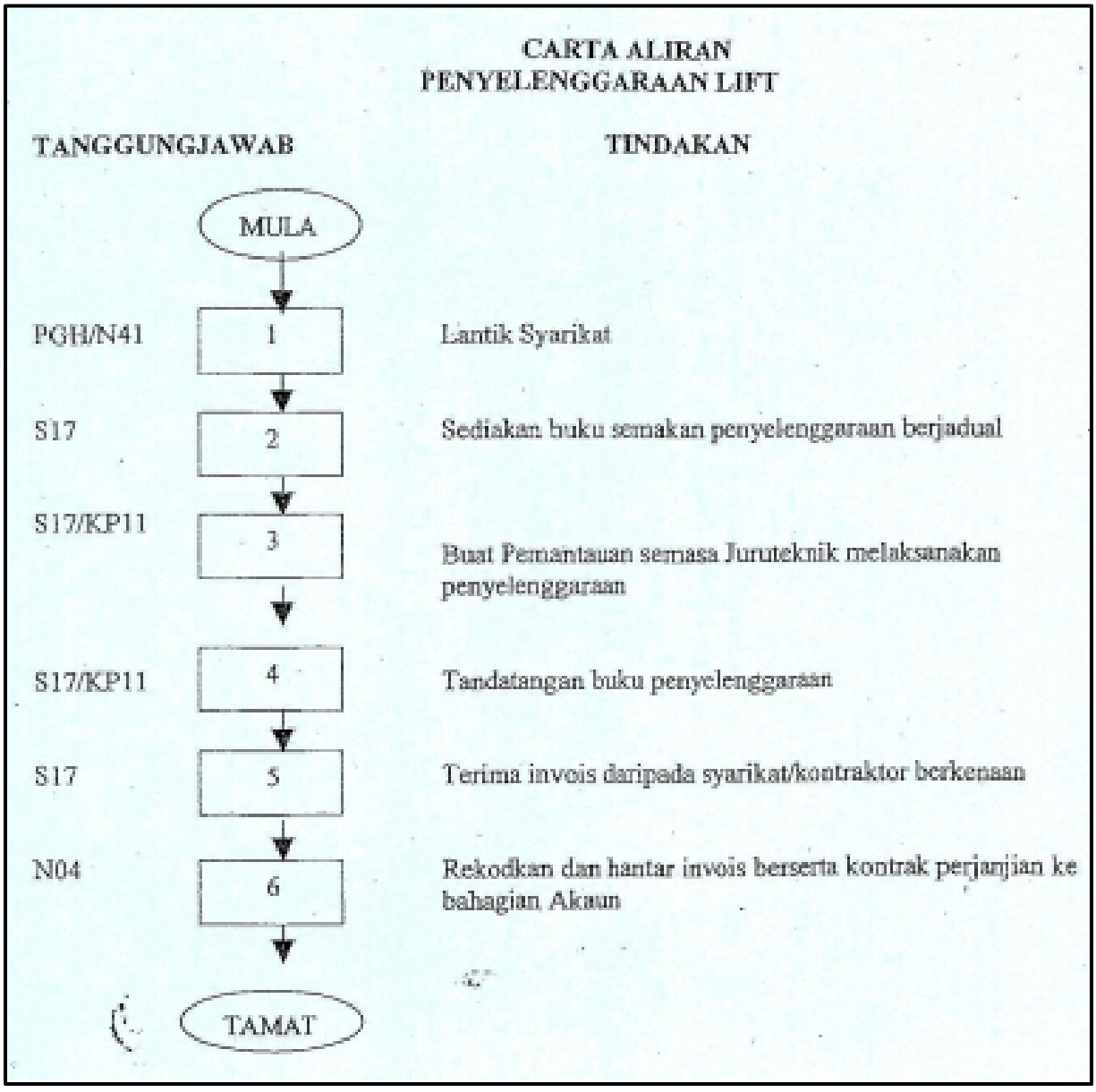
Appendix D

Flow Chart Of Maintenance Procedure Of SSL Headquarter 5



Appendix D

Flow Chart Of Maintenance Procedure Of SSL Headquarter 6



Appendix E

Asset Damage Complaint Form Of SSL Headquarters

BORANG ADUAN KEROSAKAN ASET ALIH KERAJAAN

Bahagian I (Untuk diisi oleh Pegawai Aset)

1. Jenis Aset :
2. Keterangan Aset :
3. Nombor Siri Pendaftaran :
4. Kos penyelenggaraan terdahulu (jika ada) :
5. Pengguna Terakhir :
6. Tarikh Kerosakan :
7. Perihal Kerosakan

_____

_____

_____

_____

8. Syor Pegawai Aset

_____

_____

_____

Nama:.....

Jawatan:.....

Tarikh:.....

Bahagian II (Keputusan Ketua Jabatan) Diluluskan /

Tidak Diluluskan*

.....

Tandatangan

Nama:.....

Jawatan:.....

Tarikh:.....

Nota: * Potong mana yang berkenaan

Appendix F

Contractor/Supplier Performance Appraisal Form

BORANG PENILAIAN PRESTASI KONTRAKTOR / PEMBEKAL

Nama Syarikat : .....
Alamat : .....

Kualiti Bahan	☐	☐	☐	☐	☐
Kuantiti Bahan	☐	☐	☐	☐	☐
Memenuhi spesifikasi/kehendak	☐	☐	☐	☐	☐
Kerjasama dengan pihak pengurusan	☐	☐	☐	☐	☐
Ketepatan masa	☐	☐	☐	☐	☐
Perkhidmatan susulan	☐	☐	☐	☐	☐
	1 - 2	3 - 4	5 - 6	7 - 8	9 - 10

SKALA PENILAIAN

TAHAP	SKALA	PENJELASAN
Sangat Tinggi	10 9	Mutu kerja/kualiti kerja/ tanggungjawab dalam melaksanakan perintah dan susulan perkhidmatan kerja adalah melebihi tahap maksimum
Tinggi	8 7	Mutu kerja/kualiti kerja/ tanggungjawab dalam melaksanakan perintah dan susulan perkhidmatan kerja adalah kerap kali tahap maksimum
Sederhana	6 5	Mutu kerja/kualiti kerja/ tanggungjawab dalam melaksanakan perintah dan susulan perkhidmatan kerja adalah melebihi tahap minimum
Rendah	4 3	Mutu kerja/kualiti kerja/ tanggungjawab dalam melaksanakan perintah dan susulan perkhidmatan kerja adalah kerap kali taham minimum
Sangat Rendah	2 1	Mutu kerja/kualiti kerja/ tanggungjawab dalam melaksanakan perintah dan susulan perkhidmatan kerja adalah di bawah tahapminimum

ULASAN : .....
Tandatangan :
Nama :
Jawatan :
Bahagian :
Cop Rasmi :

Appendix G

Monthly Maintenance Work Report For Generator

TDSB

Technical Report

Date	:	27/8 /2020
Location	:	Sabah State Library (HQ)
Subject/Item	:	Monthly Library generator maintenance work
Visitation(s) eatures	:	27 – 28 August 2020; 1st September 2020
Problem(s)	:	Maintenance officer complained capacitors failed in all three panels.

Maintenance List:

No.	Item	Check
1.	Generator in normal condition.	
2.	Radiator in normal condition.	[ ]
3.	Alternator in normal condition.	[✓]
4.	Generator control panels in normal condition.	[ ]
5.	Fuel tank level with at least 25% diesel.	[✓]
6.	Batteries in working condition.	[✓]
7.	Test start response.	[✓]
8.	Cleanliness of generator room.	[✓]
9.	Security of generator room.	[✓]

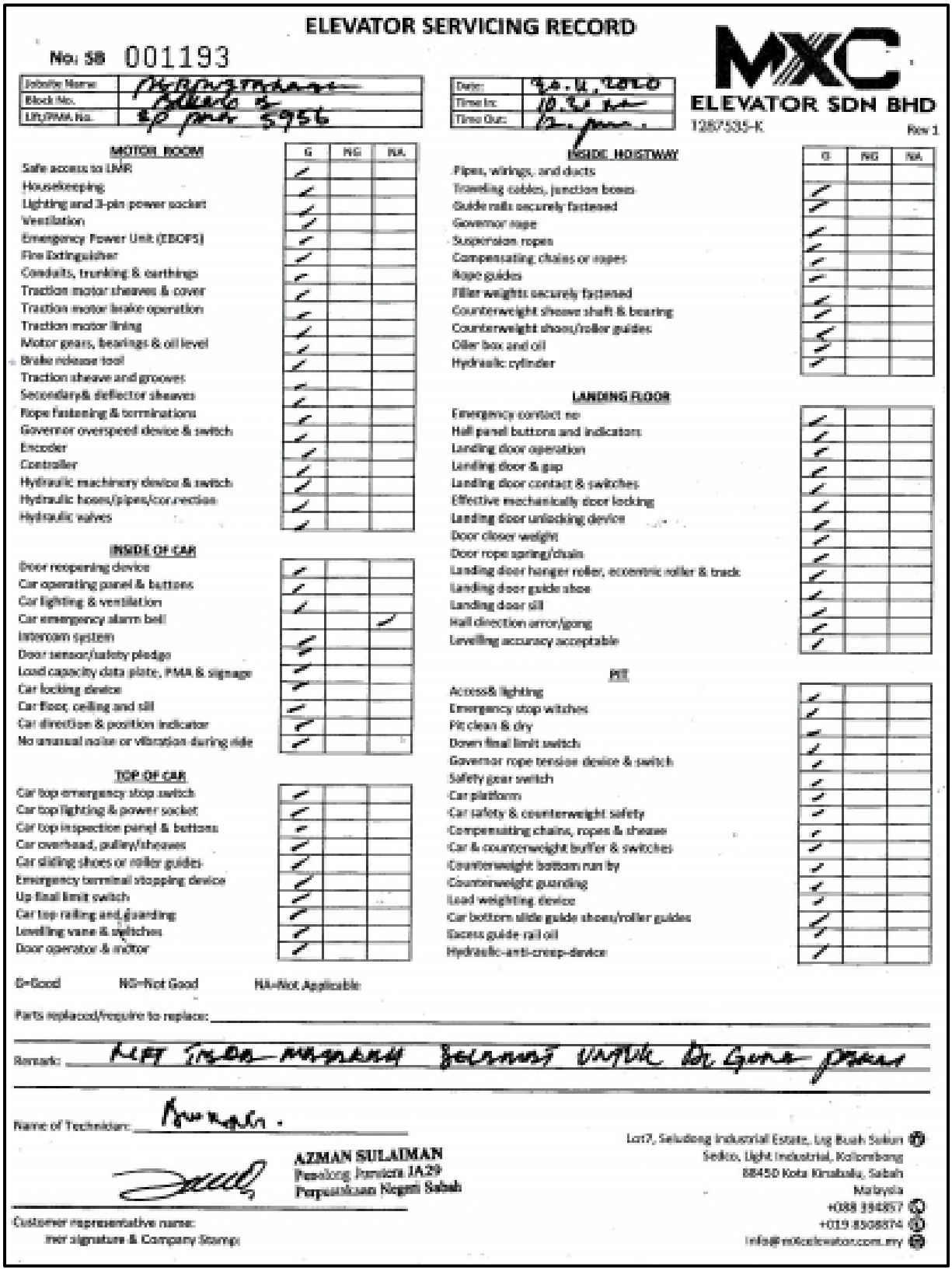
Problem(s)/Fault(s):
1. General service long over due.
2. Radiator servicing needed.
4. Responded to basic function | thus

TDSB
Co. Reg T213781-K
GST NO. : 001010012160
Shop : Lot 11, 1st Flr, Taman Fortune, Jln Penampang, 88300 Kota Kinabalu Sabah.
Postal : #2-3-4, Block B, Hilltop Apts, Luyang, 88300 Kota Kinabalu, Sabah

Patrick Chan (A188 Operation)

Shop: Lot 2, 2nd Floor, Taman Luyang-Luyang Commercial Shoplot, 88300 Kota Kinabalu, Sabah, Malaysia
Postal Address: 2-3-4,Block B, Hilltop Apartmant, Luyang,Kota Kinabalu 88300,Sabah, East Malaysia.

Monthly Maintenance Service For Elevator



ELEVATOR SERVICING RECORD

MXC ELEVATOR SDN BHD
1287535-K

No: SB 001193

Jobsite Name:	[illegible]
Block No.	Blk no 5
Lift/PMA No.	SP PMA 5956

Date:	9.4.2020
Time In:	10.30 am
Time Out:	12 pm.

Rev 1

MOTOR ROOM	G	NG	NA
Safe access to LMR	✓		
Housekeeping	✓		
Lighting and 3-pin power socket	✓		
Ventilation	✓		
Emergency Power Unit (EBOPS)	✓		
Fire Extinguisher	✓		
Conduits, trunking & earthings	✓		
Traction motor sheaves & cover	✓		
Traction motor brake operation	✓		
Traction motor lining	✓		
Motor gears, bearings & oil level	✓		
Brake release tool	✓		
Traction sheave and grooves	✓		
Secondary& deflector sheaves	✓		
Rope fastening & terminations	✓		
Governor overspeed device & switch	✓		
Encoder	✓		
Controller	✓		
Hydraulic machinery device & switch	✓		
Hydraulic hoses/pipes/connection	✓		
Hydraulic valves	✓		

INSIDE OF CAR			
Door reopening device	✓		
Car operating panel & buttons	✓		
Car lighting & ventilation	✓		
Car emergency alarm bell			✓
Intercom system	✓		
Door sensor/safety pledge	✓		
Load capacity data plate, PMA & signage	✓		
Car locking device	✓		
Car floor, ceiling and sill	✓		
Car direction & position indicator	✓		
No unusual noise or vibration during ride	✓		

TOP OF CAR			
Car top emergency stop switch	✓		
Car top lighting & power socket	✓		
Car top inspection panel & buttons	✓		
Car overhead, pulley/sheaves	✓		
Car sliding shoes or roller guides	✓		
Emergency terminal stopping device	✓		
Up final limit switch	✓		
Car top railing and guarding	✓		
Levelling vane & switches	✓		
Door operator & motor	✓		

INSIDE HOISTWAY	G	NG	NA
Pipes, wirings, and ducts			
Travelling cables, junction boxes	✓		
Guide rails securely fastened	✓		
Governor rope			
Suspension ropes	✓		
Compensating chains or ropes	✓		
Rope guides	✓		
Filler weights securely fastened	✓		
Counterweight sheave shaft & bearing	✓		
Counterweight shoes/roller guides	✓		
Oiler box and oil	✓		
Hydraulic cylinder	✓		

LANDING FLOOR			
Emergency contact no	✓		
Hall panel buttons and indicators	✓		
Landing door operation	✓		
Landing door & gap	✓		
Landing door contact & switches	✓		
Effective mechanically door locking	✓		
Landing door unlocking device	✓		
Door closer weight	✓		
Door rope spring/chain	✓		
Landing door hanger roller, eccentric roller & track	✓		
Landing door guide shoe	✓		
Landing door sill	✓		
Hall direction arror/gong	✓		
Levelling accuracy acceptable	✓		

PIT			
Access& lighting	✓		
Emergency stop witches	✓		
Pit clean & dry	✓		
Down final limit switch	✓		
Governor rope tension device & switch	✓		
Safety gear switch	✓		
Car platform	✓		
Car safety & counterweight safety	✓		
Compensating chains, ropes & sheave	✓		
Car & counterweight buffer & switches	✓		
Counterweight bottom run by	✓		
Counterweight guarding	✓		
Load weighting device	✓		
Car bottom slide guide shoes/roller guides	✓		
Excess guide rail oil	✓		
Hydraulic-anti-creep-device	✓		

G=Good NG=Not Good NA=Not Applicable

Parts replaced/require to replace: _____

Remark: LIFT INSIDE MAINTENANCE BECAUSE UNTUK DE GUNA PEKAN

Name of Technician: [illegible]

AZMAN SULAIMAN
Pembantu Pemeriksa JA29
Perpustakaan Negeri Sabah

Customer representative name:
their signature & Company Stamp:

Lot7, Seludong Industrial Estate, Lrg Buah Sukun
Sedco, Light Industrial, Kolombong
88450 Kota Kinabalu, Sabah
Malaysia
+088 394857
+019 8508874
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