POLITEKNIK MALAYSIA

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KOLEJ KOMUNITI MALAYSIA

BUILDING MAINTENANCE MANAGEMENT

Building Investigation Procedure And Maintenance Work Report

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CIVIL ENGINEERING DEPARTMENT

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PREFACE

DCB50242 - BUILDING MAINTENANCE MANAGEMENT provides the students with knowledge on basic organizational and managerial concepts in building maintenance management. This course emphasizes on the types, categories, and characteristics of building maintenance system. This course also discusses the maintenance works, work schedule and tasks implementation, budget preparation, and record keeping to ensure the quality of building maintenance operations.

This eBook is focuses on the building investigation procedure and maintenance work report, coupled with an overview of case study which has been taken into consideration on writing this book. The content of this eBook also considered to fulfilled the Diploma of Building Services Engineering content parts of syllabus.

ACKNOWLEDGEMENT

Assalamualaikum w.b.t and peace be upon you,

Grateful to Allah because with His grace we have completed this Building Investigation Procedure And Maintenance Work Report : e-Book as one of the sub-topics in the Building Maintenance Management's Course. Throughout the development period of this eBook, we have gained varieties of experience, both bitter and sweet that were invaluable and meaningful in our lives as an educator. The experiences we gained throughout the development period will probably come once in our lives.

On this occasion, we would like to thank all the parties involved throughout the success of this task. Especially to, Ir. Ts. Khairul Faizal, I.A.P, MIEM (ACI - ICAO International Airport Professional) since he has provided a lot of relevant knowledge sharing in some of the contents in this eBook. His guidance was very helpful for us in completing this eBook that has been entrusted to us.

Also, we would like to thank to our family's members and friends whom has given plenty of moral support and cooperation during completing this eBook.

Finally, appreciation was also given to all parties who have provided good support directly or indirectly to the production of this eBook. We were hoping that this eBook can be referred as well as beneficial to all parties involved in building maintenance. To polytechnic's or university's student, this eBook can be use as an additional references. The author apologizes for any errors and do not hesitate to contact the author via email: zarinamatsapri@psa.edu.my on any matters.

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CONTENTS

CHAPTER 1

INTRODUCTION TO BUILDING MAINTENANCE

The terms in management, maintenance and maintenance Management, Importance of Maintenance Management Rules And Regulation Related To Building Maintenance Management, Objectives Of Maintenance Management

Management

Management comprises planning, organizing, staffing, leading or directing, and controlling an organization (a group of one or people or entities) or effort for the purpose of accomplishing a goal. Resourcing encompasses the deployment and manipulation of human resources, financial resources, technological resources and natural resources.

"Your work is going to fill a large part of your life, and the only way to be truly satisfied is to do what you believe is great work. And the only way to do great work is to love what you do."

– Steve Jobs, former CEO at Apple

"The successful warrior is the average man, with laser-like focus." - Bruce Lee

Maintenance

In Malaysia, the buildings are built according to the standard that set by British and under strict supervision. However, in the aspects of maintenance for the buildings it is still very weak. The repair works will go up to millions if no proper maintenance works are done for the buildings (Anthony, 2013). Therefore, it is important for a building to conduct regular maintenance to prevent unnecessary repair works. In general, the activities for building maintenance can be categorized into two types which is repair work and rehabilitation work.

Repair work is an action to be taken in order to refurbish the building into the original appearance while for rehabilitation work is to allow the building maintain to a condition which it is acceptable and normally it often needs perfection or improvements as well. Besides that, the main functions of maintenance for a building is as following (Ahmad Ramly, 2002):

i. **To provide a comfortable, safe and healthy building to the occupants**
ii. **To increase the profit to the maximum especially for owners of shaped building industry, business or private oriented**
iii. **To get maximum performance by using lowest cost for public owned buildings, oriented security and non-profit**

"Intelligence without ambition is a bird without wings." – *Salvador Dali*

Maintenance

British Standard Glossary of terms (3811:1993) defined maintenance as:

"the combination of all technical and administrative actions, including supervision actions, intended to retain an item in, or restore it to, a state in which it can perform a required function"

From this definition two key components can be identified:

- ❑ not only actions that relate to the physical execution of maintenance work, but also those concerned with its initiation, financing and organization
- ❑ the notion of an acceptable condition, which implies an understanding of the requirements for the effective usage of the building and its parts, which in turn compels broader consideration of building performance.

"Perfection is not attainable, but if we chase perfection, we can catch excellence." - *Vince Lombardi*

Building Maintenance Management

Maintenance management is an orderly process to control the maintenance resources and activities required to preserve assets at, or repair them to, an acceptable working order. Necessary action or task to be taken for keeping a building functional and livable.

Why is it required?

To avoid any disruption on the day-to-day utilization and align with establish Malaysian act and regulation related to building and its facilities.

Importance of Maintenance Management

Maintenance management is responsible for the smooth and efficient working of the industrial plant and helps in improving the productivity.

It also helps to keep the machines/equipment in their optimum operating conditions. Thus, plant maintenance is an important and inevitable service function of an efficient production system. It also helps in maintaining and improving the operational efficiency of the plant facilities and hence contributes towards revenue by decreasing the operating cost and improving the quality and quantity of the product being manufactured.

As a service function it is related with the incurrence of certain costs. The important component of such costs are — employment of maintenance staff, other minor administrative expenses, investment in maintenance equipment and inventory of repair components/ parts and maintenance materials.

Rules And Regulation Related To Building Maintenance Management

- Local Government Act 171
- Street Drainage and Building Act 133, 1974
- Water Services Industry Act 655, 2006
- Sewerage Services Act 508, 1993
- Electrical Supply Act 447, 1990 > ST
- Fire Service Act 341,198
- Uniform Building By-Laws 1984 > JBPM
- Occupational Safety and Health Act 514 > DOSH
- Factories and Machinery Act 139, 1967 > DOSH
- Environmental Quality Act 127, 1974 > DOE

**An ISO company shall all the act above register in their Legal Register.*

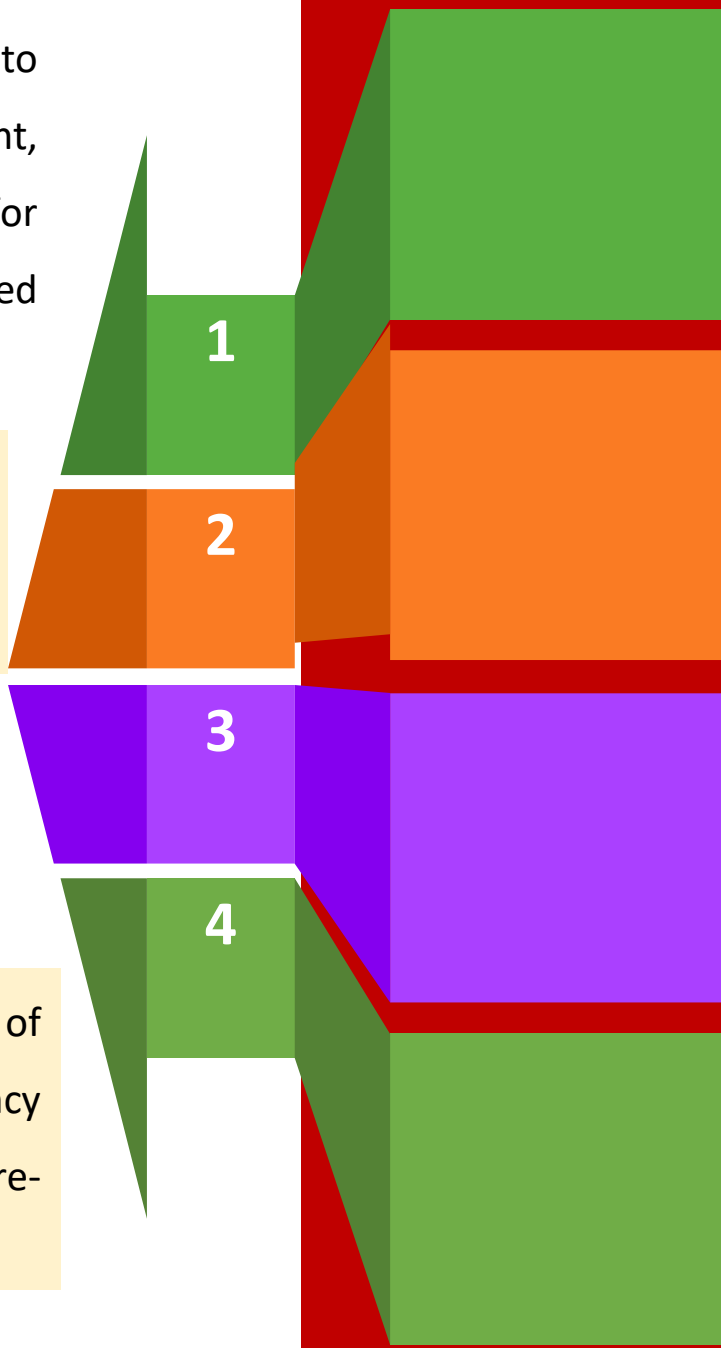
9 Main Objectives Of Maintenance Management

1) Minimizing the loss of productive time because of equipment failure to maximize the availability of plant, equipment and machinery for productive utilization through planned maintenance.

2) To extend the useful life of the plant, machinery and other facilities by minimizing their wear and tear.

3) Minimizing the loss due to production stoppages

4) To ensure operational readiness of all equipment's needed for emergency purposes at all times such as fire-fighting equipment.



9 Main Objectives Of Maintenance Management

05

5) Efficient use of maintenance equipment's and personnel.

06

6) Minimizing the loss of productive time because of equipment failure to maximize the availability of plant, equipment and machinery for productive utilization through planned maintenance.

07

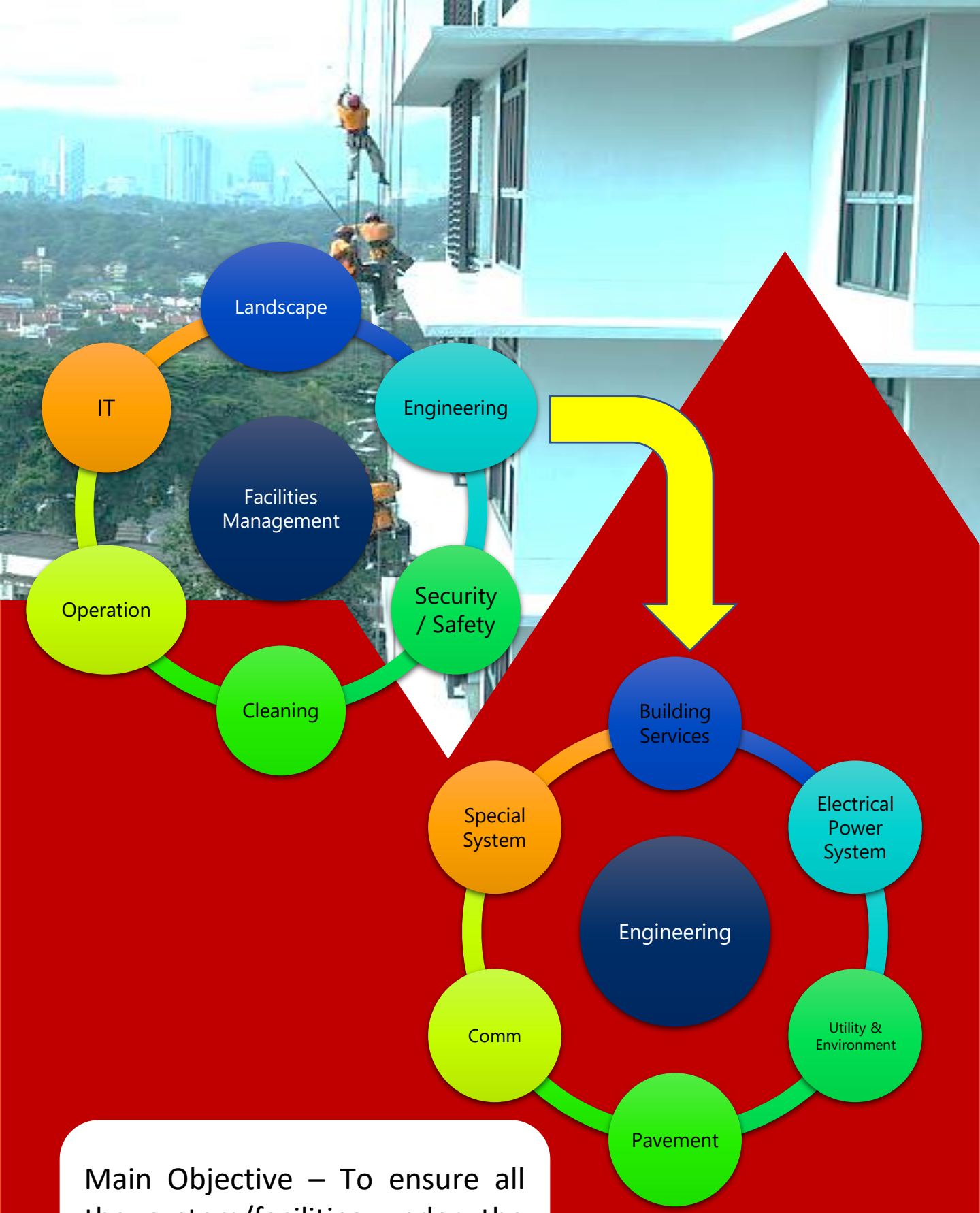
7) To extend the useful life of the plant, machinery and other facilities by minimizing their wear and tear.

08

8) Minimizing the loss due to production stoppages.

09

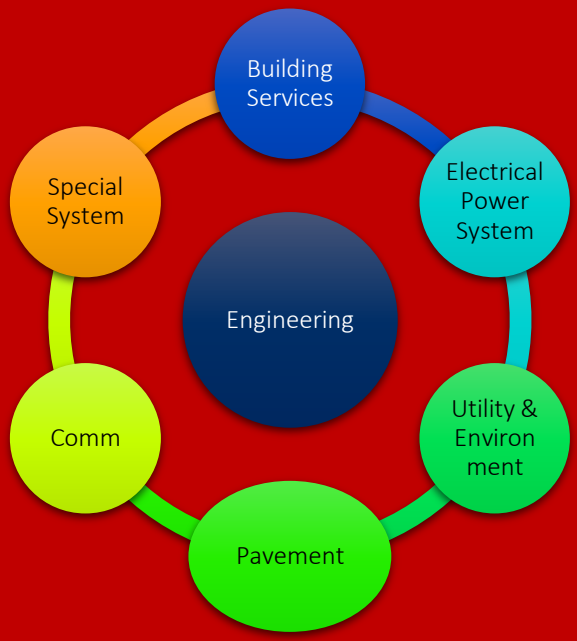
9) To ensure operational readiness of all equipment's needed for emergency purposes at all times such as fire-fighting equipment



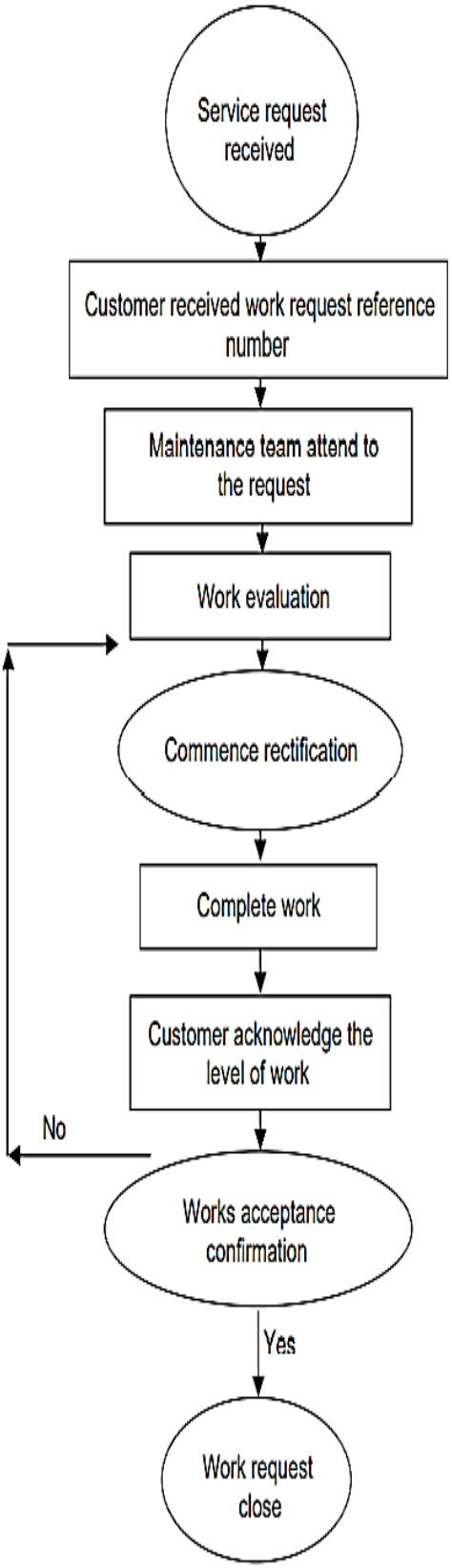
Main Objective – To ensure all the system/facilities under the care shall be in good condition with seamless operation.

Source : Malaysia Airports Holdings Berhad

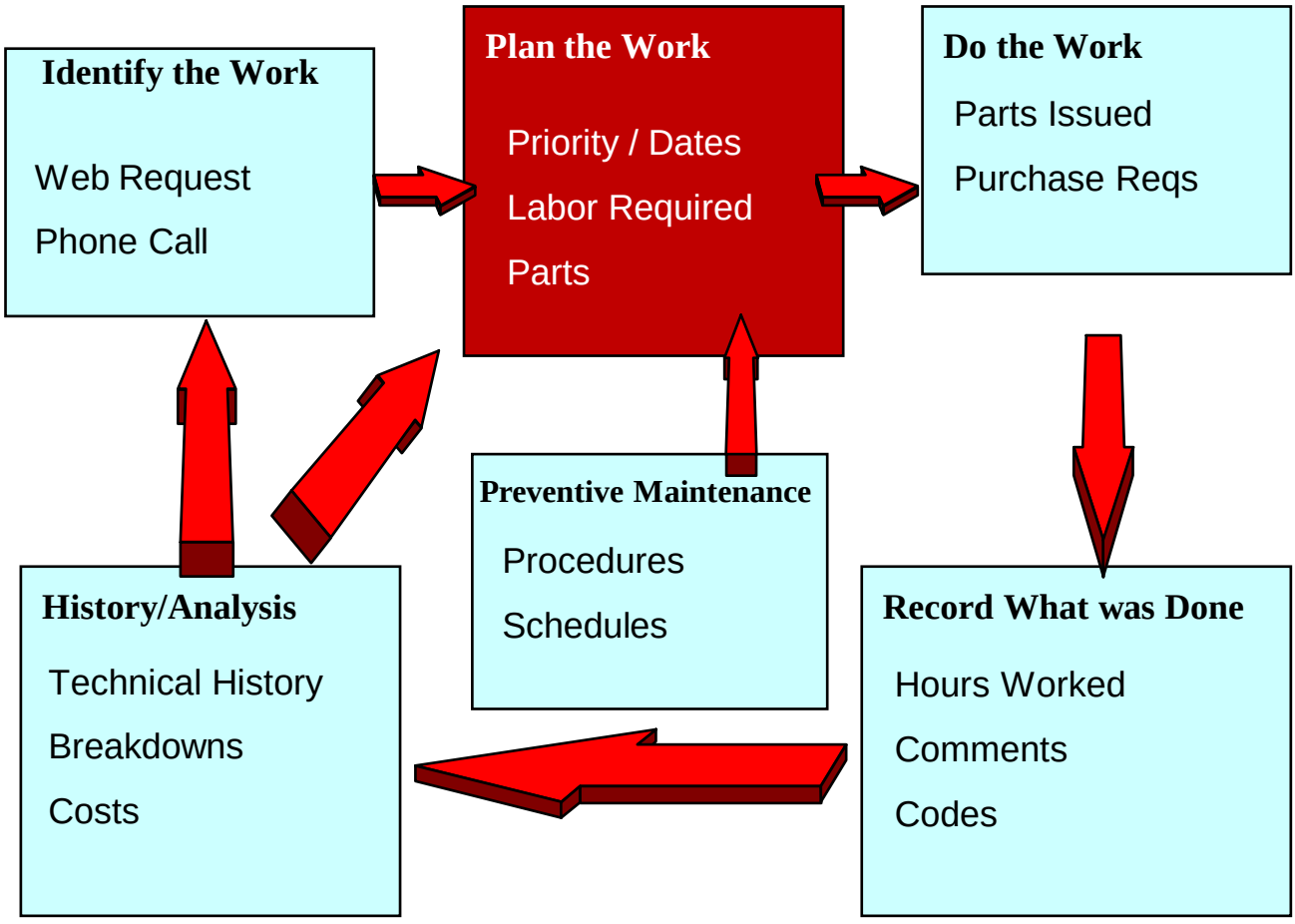
- High Tension Low Voltage (HTLV) (33kV-400V) > **Electrical Power System**
- Air Conditioning Mechanical Ventilation (ACMV) > **Building Services (BS)**
- Fire Protection System > **Building Services**
- Building Management System > **Building Services**
- Private Automatic Branch Exchange (PABX) > **Airport Communication System**
- People Mover (Elevator, Escalator, Travellator) > **BS**
- Fresh Water Supply (Internal & External building) > **BS/U&E**
- Waste Management (Sewerage, Rubbish Schedule Waste) > **U&E**
- Pavement > **Airport Pavement**
- Chilled Water Supply > **Energy Unit**
- Gas Supply > **Energy Unit**



The flow chart of maintenance management processes and procedure



Maintenance Process



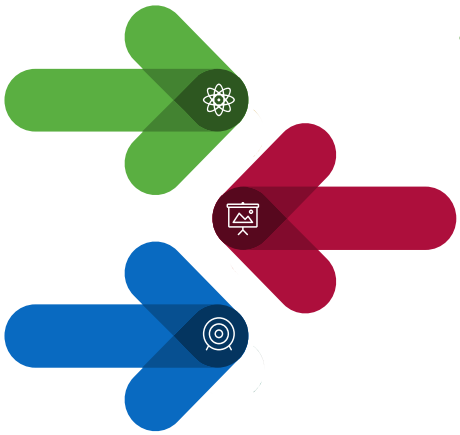
Management Structure of Building Maintenance

Management Structure Depend On The Company Policies And Financial

IN-HOUSE

Advantages
- Own specialist
- High competencies

Disadvantages
- High cost of assets/manpower over years
- Difficult to manage



OUT-SOURCE

Advantages
- Low cost*
- Easy to manage

Disadvantages
- Low of competencies*

*Depend on services

OUT-SOURCE (INTER-CO)

Advantages
- Increase inter-co company rating and profile
- Easy to appoint

Disadvantages
- High Cost
- Difficult to manage

Comparison between Comprehensive or Non-Comprehensive Maintenance Contract

Out-source (Comprehensive)

Contract cover PPM and CM

Contract amount normally high and only some portion/part will not cover such as vandalism, wear & tear.

Example: People Mover or M&E

Out-Source (Non-Comprehensive)

Contract only cover PPM (Cleaning, Checking, Tightening & Lubrication-CLCTL)

Contract amount normally lower and inclusive provision sum amount that can be utilize upon defect finding or CM.

Example: C&S Contract

Management Structure of Building Maintenance

Example of KPI / SLA

1. Service Level Agreement ("SLA")

No	Description	Key Performance Indicators
1.	Equipment Performance ("EP")	Not less than 90%.
2.	Service Availability ("SA")	99.5 % Service Availability.
*3.	Recovery Time of Facilities ("RT")	Minor works but affect airport operation - 1 hour Major works but affect airport operation - 24 hours Minor/Major works but affect duty equipment and system efficiency - 72 hours
4.	Safety, Security and Housekeeping ("SSH")	100% Compliance.
5.	PPM Efficiency Ratio ("PPM")	No less than 75%.
6.	Response Time	a) T1 & T2 Passenger Terminals - Within 15 minutes except for People Mover System (Critical – 10 mins, non-critical – 15mins) b) T2 Ancillary Buildings - Within 30 Minutes c) Aerodrome & REE (External Facilities)- 15 mins
7.	Customer Complaint	Genuine Passenger/customer compliant via media or direct communication with official Corrective Action Request (CAR) form by Terminal Service Division. Exclude due to false report, vandalism, external party interruption

Table 1: Service Level Agreement

2. Payment Adjustment

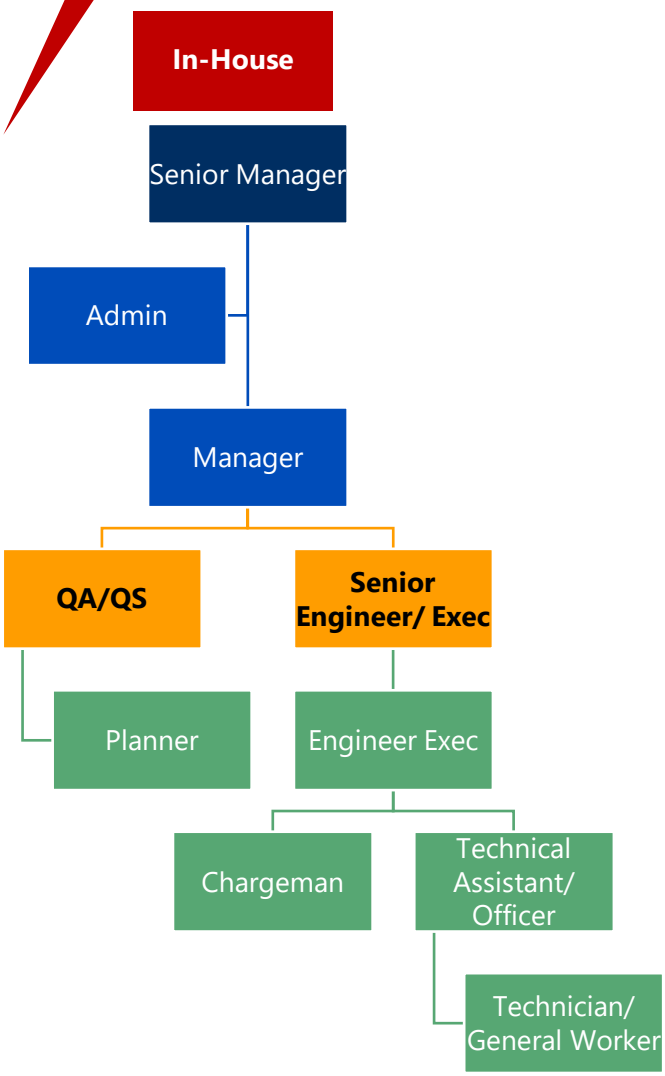
The Monthly Payments shall be adjusted by setting off the Deductions for non compliance of the prescribed Services Level Agreement. For the purposes of determining the Deductions to be made to the Monthly Payments, the following weightage and fix deduction shall be accorded to the respective categories of Services or events, as set out below:

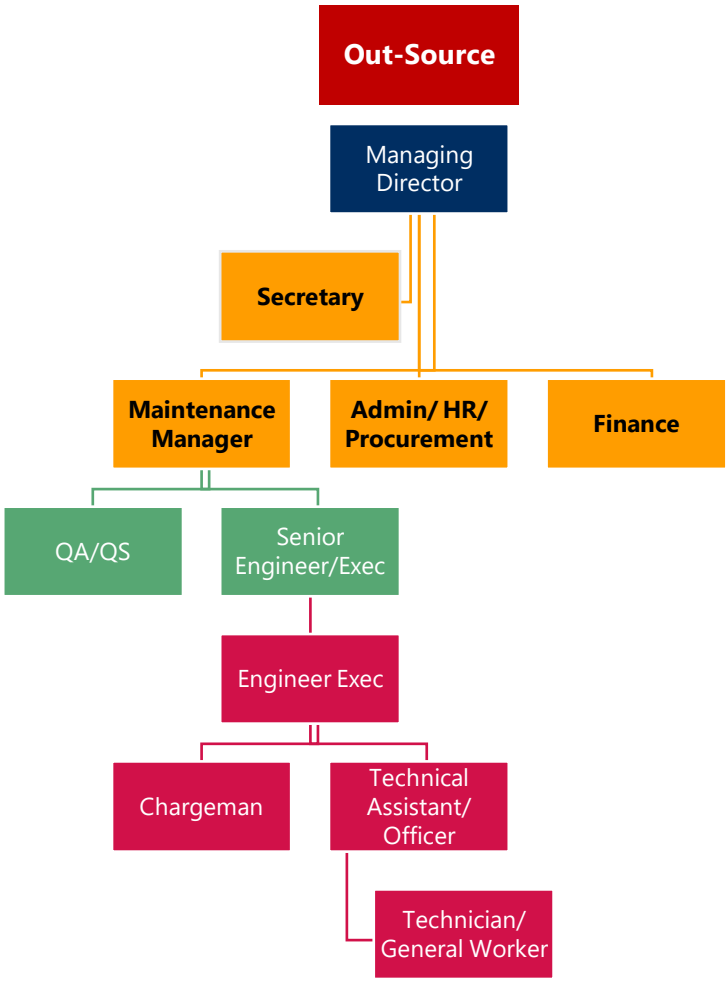
No.	Performance	Adjustment
1.	Equipment Performance ("EP")	Equipment unit contract price per month.
2.	Service Availability ("SA")	Equipment unit contract price per month.
3.	Recovery Time of Facilities ("RT")	Equipment unit contract price per month.
4.	Safety Security and Housekeeping ("SSH")	RM 200 per event.
*5.	Facilities Malfunction and cause interruption to the Airport Operation and/or Client Reputation.	RM 5,000 per equipment or per event.
6.	Response Time	RM 100 per event.
7	Customer Complaint	RM 100 per notification/complaint/report

*Definition

Affect airport operation – Significantly affect aircraft operations or the facilities inoperative to passenger/tenant/airport staff i.e. flight delay.
Affect duty equipment – The facilities is inoperative but not affect operation.
Affect system efficiency – The facilities is operative but not as per design.

Typical Ops Chart Of Building Maintenance Management





Do your exercise

1. **List 10 Rules And Regulation Related To Building Maintenance Management**

2. Illustrate the flow chart of maintenance management processes and procedure

CHAPTER 1
REFERENCES

Anthony, L. T., 2013. New buildings could also have structural defects. [Online] Available at: http://www.themalaymailonline.com/malaysia/article/new-buildings-could-also-have-structural-defects

Ahmad Ramly (2002), Pengurusan Penyelenggaraan Bangunan, Pustaka Ilmu, Malaysia

British Standards Institute (1984) BS 3811: 1984 Glossary of Maintenance Management Terms in Terotechnology. HMSO, London.

https://ftmaintenance.com/maintenance-management/what-is-maintenance-management/

Investigating building maintenance practices in Malaysia: a case study
Abdul Lateef Olanrewaju, Arazi Idrus and Mohd Faris Khamidi
Department of Civil Engineering, Universiti Teknologi Petronas, Tronoh, Malaysia

Malaysia Airport Holdings Berhad.

CHAPTER 2

BUILDING INVESTIGATION PROCEDURE

Investigation Of Defects In New Buildings In Malaysia , Investigation of Heritage Buildings, Maintenance Tools, Investigation Equipment, Investigation Work, Investigation Report And Method Of Reporting Defects

"Opportunity is missed by most people because it is dressed in overalls and looks like work." - *Thomas Edison*

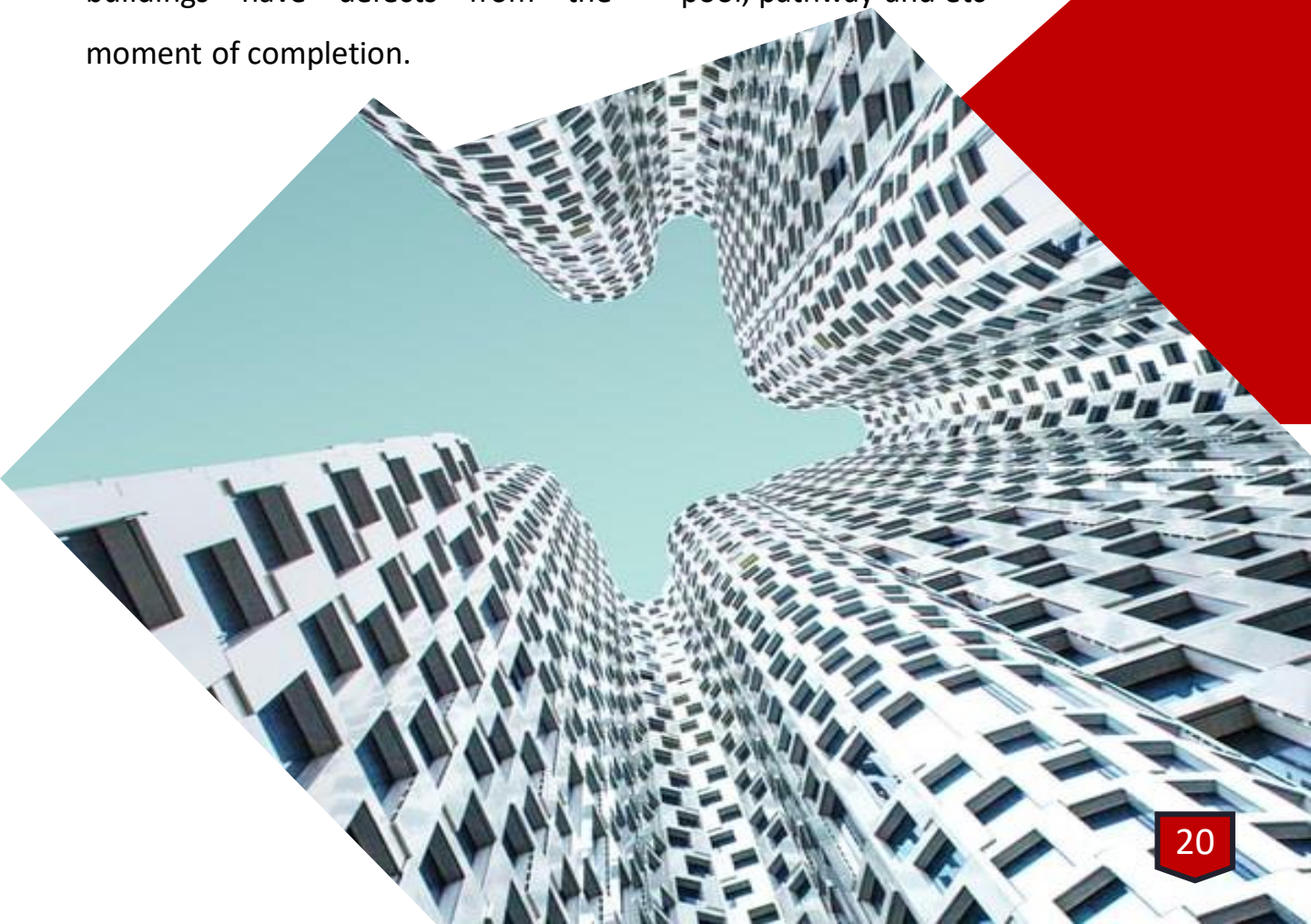
Investigation Of Defects In New Buildings In Malaysia

In this modern era, there are more and more-high rise buildings being developed by the clients or the contractors due to the reason of insufficient land use and high population of people. New buildings mean different thing to different people. In fact, there is not exact definition for what is meant by new building.

However, the definition is centre around the age of the buildings. While some might consider building less than five years old as new building some might considered building less than ten years old as new. New building is defined as building within the defect's liability period. In Malaysia, the defects liability period is from 12 months to 24 months which is 1 to 2 years (Minter, 2016). After that, the buildings will be defined as new which is free from DLP.

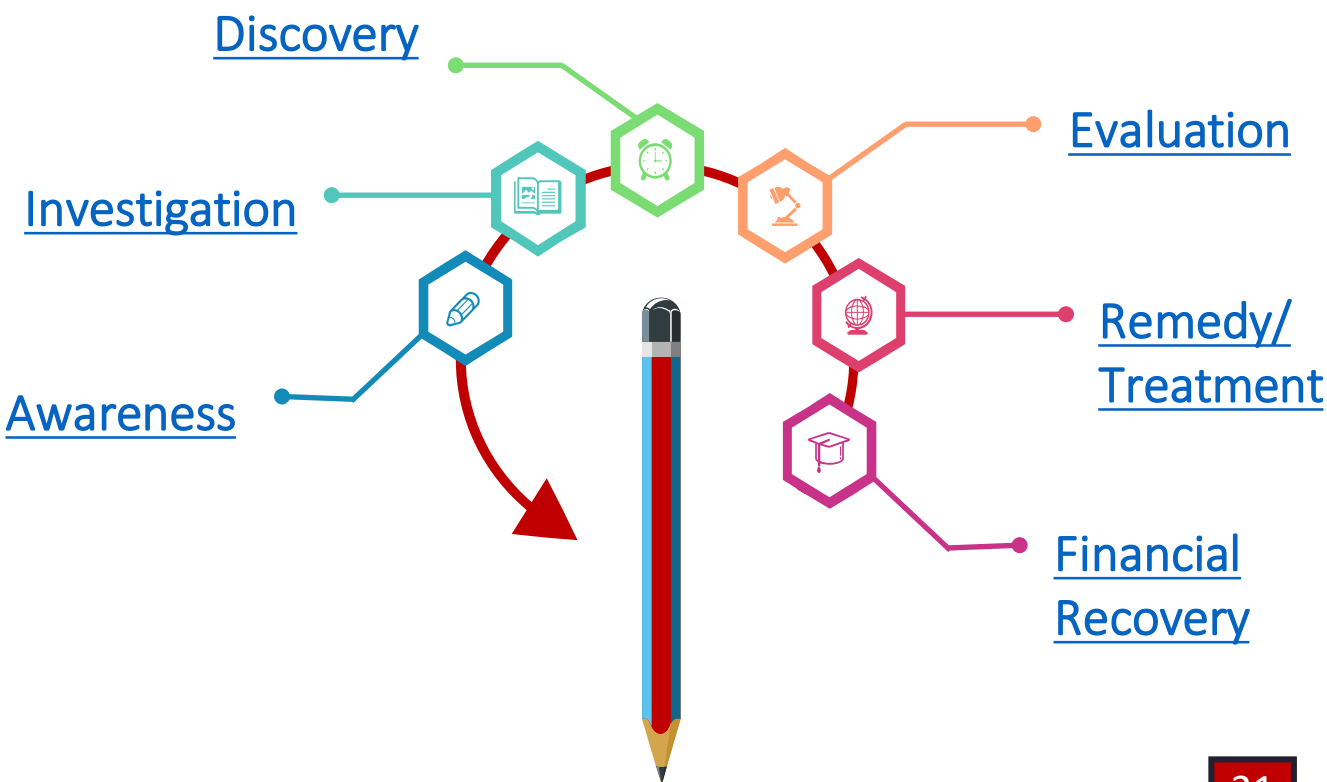
In Malaysia, high-rise buildings less than 10 years old would have structural defects that can cause danger to the residents and also to the public (Anthony, 2013). In fact, all new buildings have problems in defects like surface cracks, leakage occur in electrical riser or shortcoming in workmanship. The reason why many defects occur in the new high-rise buildings was due to poor workmanship of the labour, lack of skilled supervision and etc. The most important is many new high-rise buildings have defects from the moment of completion.

Based on the research done by Anthony (2013), he has inspected more than hundreds of old and new high-rise buildings in the nationwide and found out that many defects occur in the new buildings that they have inspected for vacant possession. Normally, there is a 24 months of liability period for the owners to submit a complaints to the developer to rectify the defects. The owners are just concern about their own units but no concern about the common facilities like elevators, swimming pool, pathway and etc



Six Process to Managing Defects in New Buildings

(Frank, 2013).



1 AWARENESS

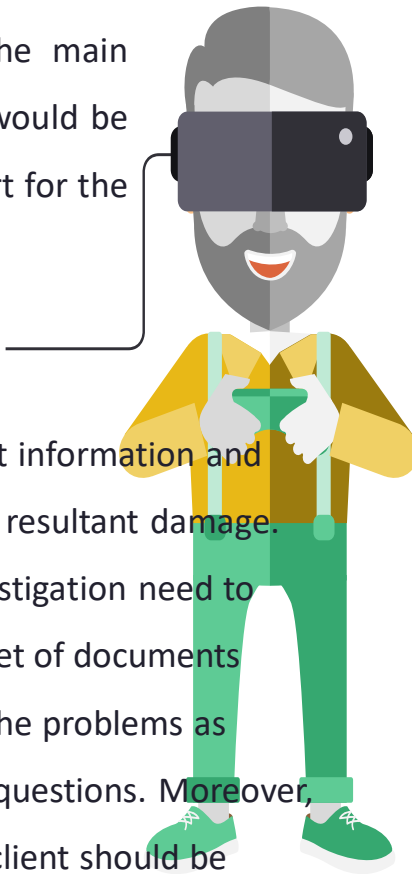
The first step in the process of the awareness is the identification of the defects in new buildings. Normally, the manifestation of the defects are usually the first clue where it shows something, or part of the buildings are not quite right, and a further investigation is required on it. A defect that occur in the new buildings are the results of default or deficiency of a specific part of the building systems. Deficiency or default can be broadly defined as malfunction, low quality of a system, materials or any components

2 INVESTIGATION

After the defects have been aware, an investigation will be carried out. A detail investigation which include inspection of the buildings in order to observe the manifestation of the defects. This type of investigation is executed without any demolition work and is done to identify any conditions that may show the existence of defects. The main function of this investigation is to get as much as information that is required to the owner of the buildings so that it would not incur a great expense. In addition, an informed decision can be made about what further action is required or any recommendations that are needed.

3 DISCOVERY

Third step would be the discovery process. After the investigation process has been completed, a further discovery is required in order to identify the parties that are responsible for the construction and design stages of the new buildings. For example, the determination need to be made to identify whether the materials or items that are malfunction are covered under the warranty issued by the main contractors or subcontractors. Other than that, parties that would be involved need to be notified. This is to allow them to take part for the evaluation and remedy process as well as financial recovery.



4 EVALUATION

The person or an individual who in-charge of the investigation need to determine and evaluate whether the defects are belongs to practical or academic value other than just to identify and observe the defects. It is advisable that all the parties for instance architect, consultants, site engineers and contractors take part in the evaluation process so that they can provide more solutions and ideas for it. Besides that, the evaluation process need to test for the presence and hazards of the defects as identified in the first step which is investigation process. The objective of doing this is to collect sufficient information and data to detect any resultant damage. However, this investigation need to have a complete set of documents which is allied to the problems as mentioned in the questions. Moreover, the owner or the client should be informed in order to make a decision whether to remedy the defects and look for compensation for damages from another party through the preparation of a claim. Any defect which might compromise health, safety and welfare of the public must be deal with immediately.

5 REMEDY OR TREATMENT

In this process, the main goal is to avoid further damages. If the defects will cause safety hazard to the buildings and also the occupants, then this step need to be followed up immediately. When rectifying the defects, the workers need to ensure that potential damages are kept to the lowest.

Furthermore, a direct and simple approach of remedy the defects will be a wise solution. However, they might deal with the replace and remove approach where some of the components and materials need to be removed because of major damages.

6 FINANCIAL RECOVERY

If the owner has the intention to claim for the damages, he/she should look at its insurance coverage. Normally the policies of the insurance just to cover the amount to repair the damages due to the defects but it does not cover the cost the rectify the defects itself.

However, if the insurance coverage is presence and the payment has made against it, the owner has to right to claim back the cost to repair the defects from the responsible party. Likewise, if there are no insurance coverage, the owner can make a decision whether they want to repair the defects against the responsible parties.

"You are today where your thoughts have brought you; you will be tomorrow where your thoughts take you." - ***James Allen***

Investigation of Heritage Buildings

Heritage buildings are the repositories of history past, present future, which are preserved (Feilden 1979) for posterity (Prentice 1993). In addition, heritage buildings embody cultural resources (Feilden 1994: 2003) and architectural values (Kamaruzzaman et al. 2011), Heritage buildings can be generally classified as cultural property (UNESCO 1972). The National Heritage Act (Act 645) of Malaysia also defines heritage buildings as 'monuments, which include elements or structures of outstanding universal value from a historical, artistic or scientific point of view (The Commissioner of Law Revision, Malaysia 2005). According to the Burra Charter (2013), heritage buildings are either individual or in groups, associated with heritage events, and inherited with cultural significances and values

The field investigation of a building will normally follow preliminary documentary research. At its simplest, investigation involves identifying address details and obtaining a grid reference. In most cases it will involve direct observation of the building in order to ascertain what information it provides about its origins, form, function, date and development. For the lowest level of record, investigation may be limited to external observation. For more detailed levels of recording internal inspection will be required, the length and intensity depending on the purpose of the record, the complexity of the building and the resources available. An initial aim of this inspection will be the clarification of what an appropriate record needs to show, if this is not already apparent from external observation.

Detailed investigation entails a thorough examination of the building's external and internal fabric, paying particular attention to:

- evidence of phasing (for example, masonry joints)
- architectural styles
- plan elements
- decorative schemes
- fixtures and fittings or other details which help to date the building or its various stages of evolution

https://historicengland.org.uk/images-books/publications/understanding-historic-buildings/heag099-understanding-historic-buildings/

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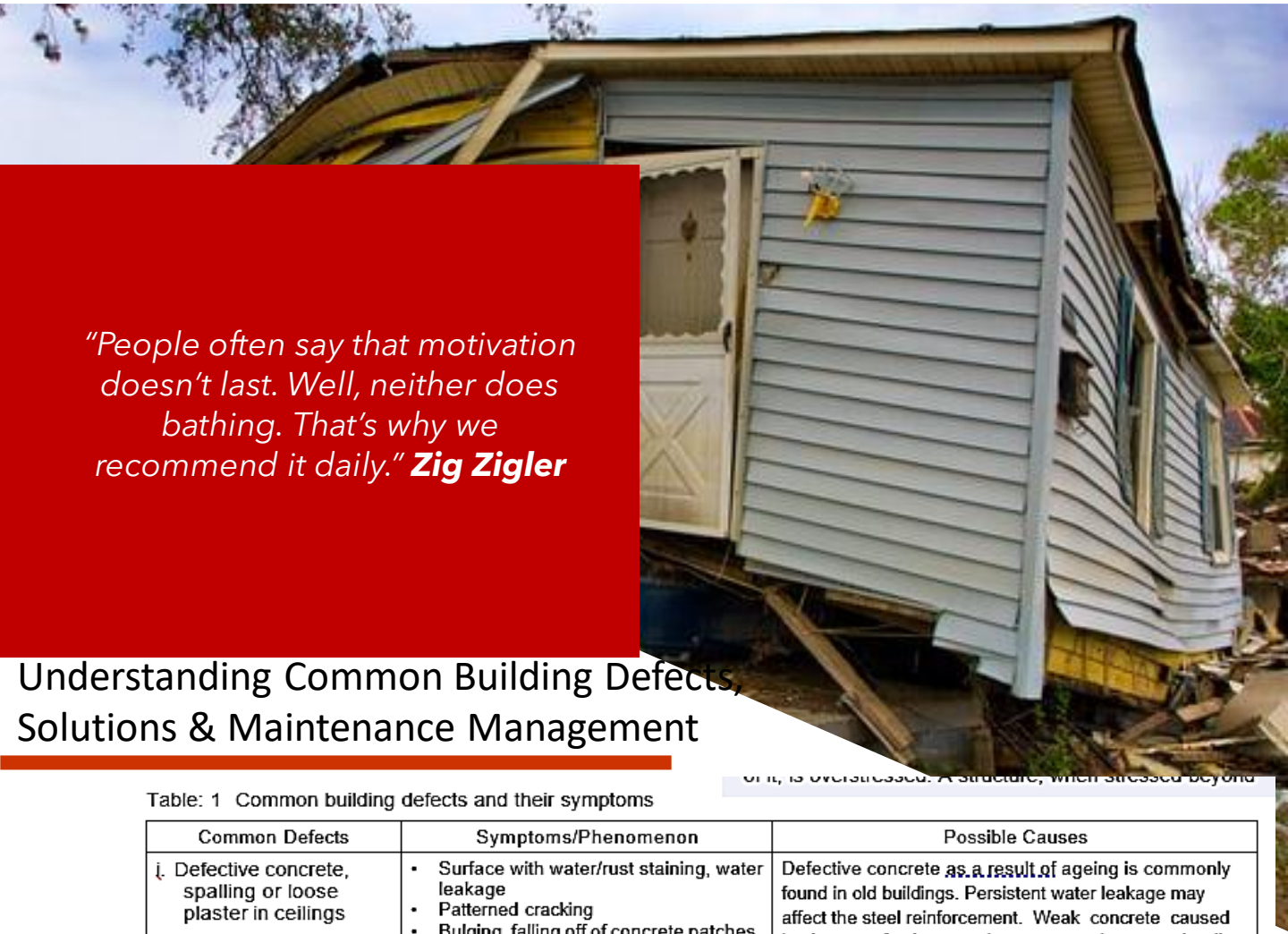

"People often say that motivation doesn't last. Well, neither does bathing. That's why we recommend it daily." ***Zig Zigler***

Understanding Common Building Defects, Solutions & Maintenance Management

Table: 1 Common building defects and their symptoms

Common Defects	Symptoms/Phenomenon	Possible Causes
i. Defective concrete, spalling or loose plaster in ceilings	• Surface with water/rust staining, water leakage • Patterned cracking • Bulging, falling off of concrete patches with reinforcement exposed, often rusty • falling off of plaster/tiles	Defective concrete as a result of ageing is commonly found in old buildings. Persistent water leakage may affect the steel reinforcement. Weak concrete caused by the use of salty water in concrete mix, or overloading are also common causes in spalling
ii. Water seepage from external wall, window, roof, or from ceiling	• Water staining • Peeling off of paint or wall paper • Water dripping • Growth of fungus • Defective concrete, plaster or tiles • Rust staining	External water seepage could be due to a variety of reasons including cracks on external wall, honey comb concrete, defective sealant at window, defective water-proofing membrane at roof, defective external water and drainage pipes, etc
iii. Structural cracks in walls	• Cracks that penetrate through finishes into the concrete or bricks • Long, continuous cracks across width of wall • Diagonal cracks at corners of window or door • Cracks with rust staining	Structural cracks may be caused by many factors, e.g. excessive movement of the building structure, unwanted ground settlement, serious overloading, weaknesses caused by corrosion/deterioration of materials, or damage by accidents, or poor design/ construction, etc. Detailed investigation must be carried out to identify the cause(s) which must be removed or rectified before the cracks are repaired
iv. Structural cracks in columns & beams	• Cracks that penetrate through finishes down to the concrete or bricks • Spalling	Same as item (iii) above.
v. Non-structural cracks (usually in plaster or other finishes with cement sand rendering as base)	• Hairline cracks • multi-directional cracks (shrinkage cracks) • Cracks between panel walls and structural elements e.g. brick wall and beams/columns	Cosmetic shrinkage cracks in plaster or other forms of finishes will affect the appearance only and do not pose any safety concern. They are small hairline cracks developed within the finishes layer not penetrating down to the reinforced concrete structure
vi. Defective external wall finishes/mosaic tiles/ ceramic tiles/stone cladding/curtain wall	• Debonding of finishes/tiles from wall structure resulting in "hollow sound" when tapped with a hammer • Cracking of wall surfaces • Bulging with hollow base • Falling off • Cracks • Loosening of parts	The defects could be due to ageing, structural move-ments, defective workmanship during installation, ther-mal movement, defective or missing expansion joints, damage by external factors (e.g. falling objects during typhoon), ingress of water into the gap between the finishes or tiles and the structure, etc.

Causes and Symptoms

Table: 2 Causes and symptoms of common defects in building services

System	Symptoms/Phenomenon	Possible Causes
i. Water Supply	• Insufficient water pressure or flows • Brownish water / grit and deposit • Stoppage of supply • Water seepage • Unclean water, algae growth, dirt and deposit • Sudden rise in consumption • Noisy water pumps, noisy water inlets	• Blockage or leakage of components of the supply system such as pipes or valves • Rusty pipes or dirty supply tanks • Pump failure, breakage of supply pipe • Defective water tanks, pipes (pipe joints) or valves • Defective or missing water tank cover • Leakage in the system after water meters • Defective water pumps, undue water pressure
ii. Electricity Supply	• Stoppage of supply / system breakdown • Sudden or frequent fuse or circuit breaker cut off leading to stoppage • Heating of switches & wires • Sudden or frequent stoppage and larger power consumption • Electric sparks or shocks, electrocution	• Failure of fuse or circuit breaker • Earth leakage, overloading • Overloading • Uneven distribution of phases • Inadequate earth bonding
iii. Fire Services	• Alarm not working (when tested), false alarm or warning lights on signal panels • Portable equipment lost or misplaced, glass panels of alarm switch- box broken • Non-functioning of equipment	• Alarm wiring defect, short circuit • Inadequate protection or poor management • Inadequate maintenance or servicing
iv. Lift and Escalator	• Stoppage, excessive noise during operation, indicator lamps off, unstable lifting, malfunction of buttons and indicator lamps • Occasional overrun • Doors not closing properly • Defective mechanical parts, frequent stoppage, alarm signals	• Ageing of parts, mechanical failure • Landing misalignment • Parts ageing, mechanical failure, rubbish obstructing operation • Inadequate servicing
v. Air Conditioing / Heating	• Not cool enough, not warm enough • Noisy, no air movement • Engines sound normal but no air movement • Noisy blowers or propellers movement • Poor indoor air quality • Dripping and substandard output of cool or warm air • Noisy blowers or propellers movement	• Poor efficiency, leakage of refrigerant dust and dirt at heat transmission fins • Loosen parts, blowers or propellers breakage • Dust screens blocked, air ducts and grilles needs cleaning • Misalignment of motor shafts • Insufficient fresh air intake, mal-function of intake air filter • Insulation failure • Misalignment of motor shafts

http://www.drfixitinstitute.com/download/rebuild_2010/Rebuild%20vol%204%20no%202%20Apr-Jun%202010/Rebuild%20vol%204%20no%202%20Apr-Jun%202nd.pdf

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Table: 3 Water leakages and their causes

Location of Leakage or Seepage	Possible Causes
i. Underside of roofs (such as flat roof, podium roofs) and bottom of light wells	• Damage or deterioration of waterproofing layer • Leakage at access doors or top hatch doors • Deterioration of corrugated steel roofing materials and joints • Defective enclosure for water tanks • Cracks of parapet walls affecting the waterproofing membrane • Inadequate protection / improper installation of sleeve around openings through roof slab • Excessive movements of construction joints
ii. Ceiling with internal areas above	• Leakage from bathroom or kitchen above usually caused by seepage from fitments, bathtubs, shower trays, buried pipes or drains due to improper construction of joints, installation of sealants or occurrence of cracks • Waterproof cement rendering underneath floor tiles for the floor above not installed/specified or such waterproofing features damaged by installation of sockets or conduits • mal-function of waterproofing in nearby external features such as balconies or external walls above
iii. Wall	• Water penetration through external wall defects such as cracks, joints, honeycombs, spalling, weak points, holes, punctures, leftovers of debris, and movement of external wall components • Water penetration through defective external wall finishes such as loosened mosaic tiles, cracked ceramic tiles & paint surface; through poor cladding or curtain walls constructions; or weaknesses in water-resisting components • Water leakage through party walls between units of pre-fabricated elements, or between buildings
iv. Floor	• Seepage from defective pipeworks or sanitary fitments • Temporary floods and overflows • Defective bathroom fitments such as bathtubs, shower trays or hand wash basins, or the improper installation of pipeworks or necessary sealants
v. Window	• Improper fillings around frames • Deformation of frame and sashes, defective gasket, sealant or putty for window glass setting or frames • Air conditioning box or platform tilting inwards • Insufficient sealant around air conditioning units
vi. Basement	• Inadequate or damaged waterproofing tanking (may be due to movements or punctures) • Deterioration of water stops at construction/movement joints
vii. Buried or underground drains or pipes	• Seepage through defective joints or pipes caused by poor installation or differential movements/ settlements, movement of building structures or ground or water table • Corrosion of pipes at junctions with floors or walls • Invasion of water into conduits and distribute throughout the network • Blockage leading to excessive pressure built up • Attack by rodents or roots of plants
viii. Exposed (or in pipe ducts) supply pipes or drains	• Inadequacy in design of drains such as insufficient diameter of drains, bends being too sharp, etc. • Blockage of drains by rubbish/sand collected in the system especially in bends or traps • Insufficient number or deterioration of brackets leading to hammering and breakage of supply pipes • Blockage of open joints such as hoppers of down pipes by plants or rubbish • Unauthorized additions overloading the drainage system

http://www.drfixitinstitute.com/download/rebuild_2010/Rebuild%20vol%204%20no%202%20Apr-Jun%202010/Rebuild%20vol%204%20no%202%20Apr-Jun%202nd.pdf

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"When you change your thoughts, remember to also change your world."–***Norman Vincent Peale***

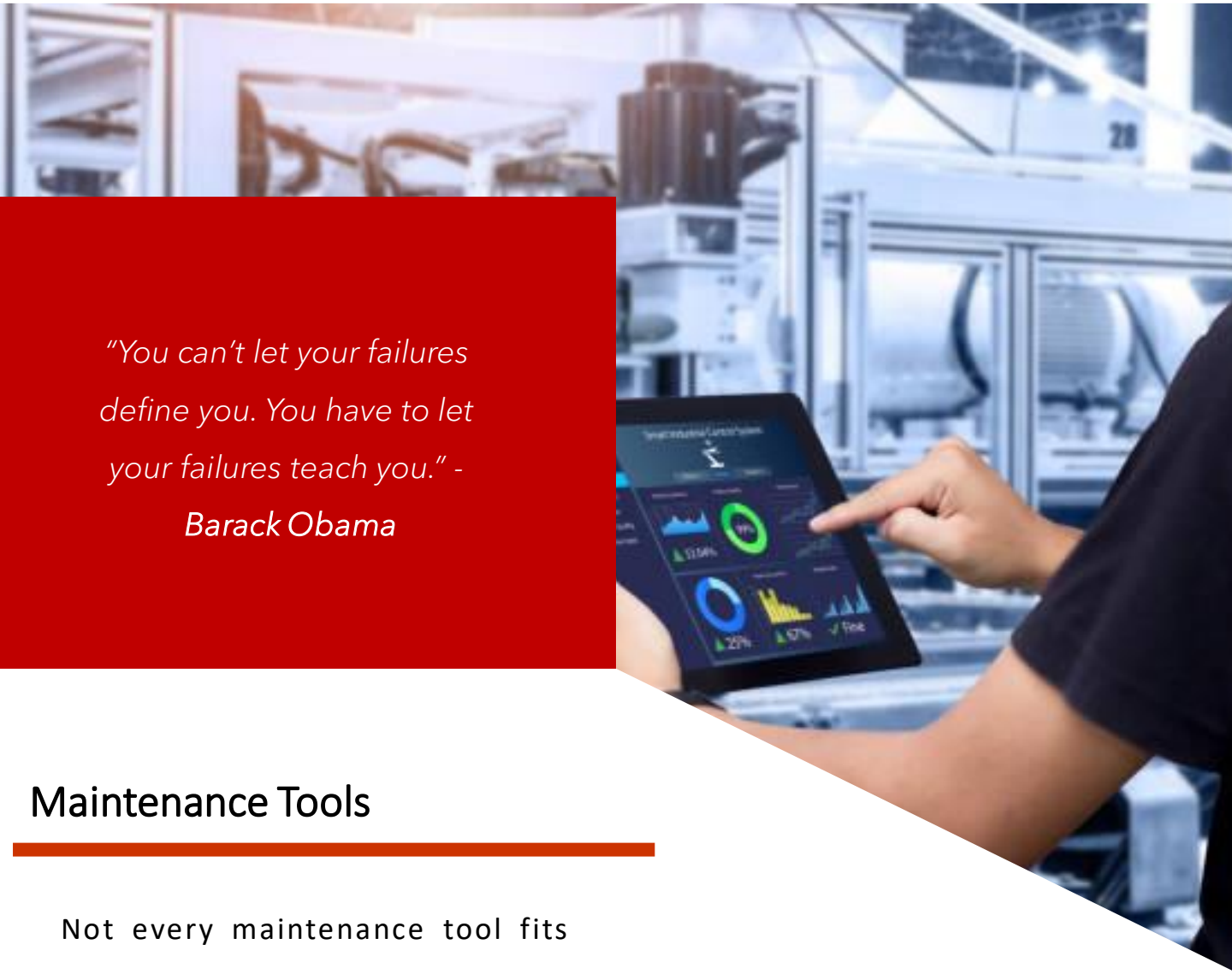
Investigation Equipment

https://www.youtube.com/watch?v=QjR5FtpupQ8&t=60s

YouTube MY

qlassic SERVICES

CLICK HERE



"You can't let your failures define you. You have to let your failures teach you." -

Barack Obama

Maintenance Tools

Not every maintenance tool fits on a tool belt, and not every maintenance tool is designed for repairing assets. Other tools exist that help maintenance teams improve things beyond physical assets. For instance, various types of analyses are used to gather insights about why and when assets fail. And standards, regulations, and other documentation exist to keep maintenance teams organized and compliant.

Using these maintenance tools will help you build environment in which proactive maintenance and precision maintenance can thrive.

https://www.onupkeep.com/learning/maintenance-tools

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Maintenance Tools

P-F Curve
A P-F curve is a graph that shows the health of equipment over time to identify the interval between potential failure and functional failure.

FMEA
Failure Mode and Effects Analysis (FMEA) is a process that is available to organizations to identify potential failures with assets and other areas of business.

Root Cause Analysis
Root cause analysis (RCA) is a systematic process of identifying the origin of an incident.

Lean Six Sigma
Lean Six Sigma is a process that aims to systematically eliminate waste and reduce variation.

SCADA System
Supervisory control and data acquisition (SCADA) systems are a computer system used to monitor and control plant processes.

Planned Maintenance Optimization
Planned Maintenance Optimization (PMO) is a method of improving maintenance strategies based on existing preventive maintenance (PM) routines and available failure history.

https://www.onupkeep.com/learning/maintenance-tools

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What is an equipment maintenance log?

An equipment maintenance log is a document that records activities that have been performed on an asset.

It takes at least a handful of key equipment to keep a plant operational. It is unimaginable how much time and effort goes into maintenance activities for each asset annually. Compounded by the total number of equipment and combined years of operation, documentation of maintenance tasks can easily get out of hand without a systematic process for tracking activities.

3 Types Of Maintenance Logs

1) Maintenance Schedule Logs

Timetable for all the projects in progress within an organization. These logs provide a holistic overview of everything the company is working on at any given time, as well as an expected timeline for completion.

2) Machinery Maintenance Logs

Machinery maintenance logs contain information about scheduled maintenance for all of the machines used by the organization. These logs ensure that teams service their machinery within the specified interval to keep it operating efficiently.

3) Project Logs

Project logs track the company's current projects. Similar to maintenance schedule logs, they help organizations look at ongoing work and expected completion timelines. Project logs may include maintenance schedule logs, as well as projects from other departments. They also cover completed projects.

[Equipment Maintenance Log [Template & Benefits] - UpKeep (onupkeep.com)]

LEARN MORE

https://blog.ezofficeinventory.com/equipment-maintenance-log/

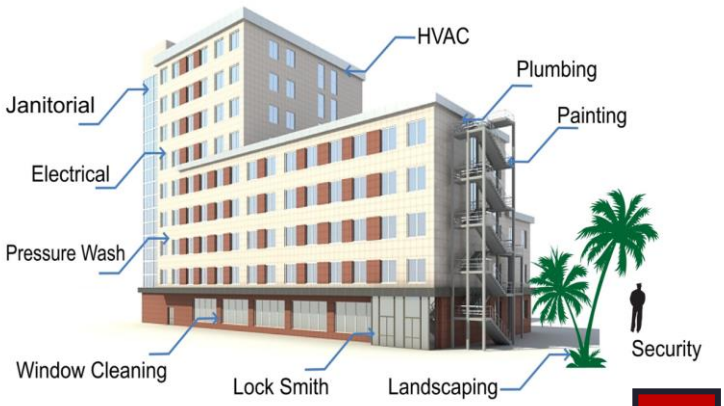
What is Building Maintenance Checklist?

A building maintenance checklist helps facility managers and maintenance supervisors oversee the upkeep of a facility to make sure that it is safe and that daily operations are running smoothly. Take advantage of mobile-ready building maintenance checklists to never miss another maintenance check, proactively resolve detected issues, and maintain facility management standards.

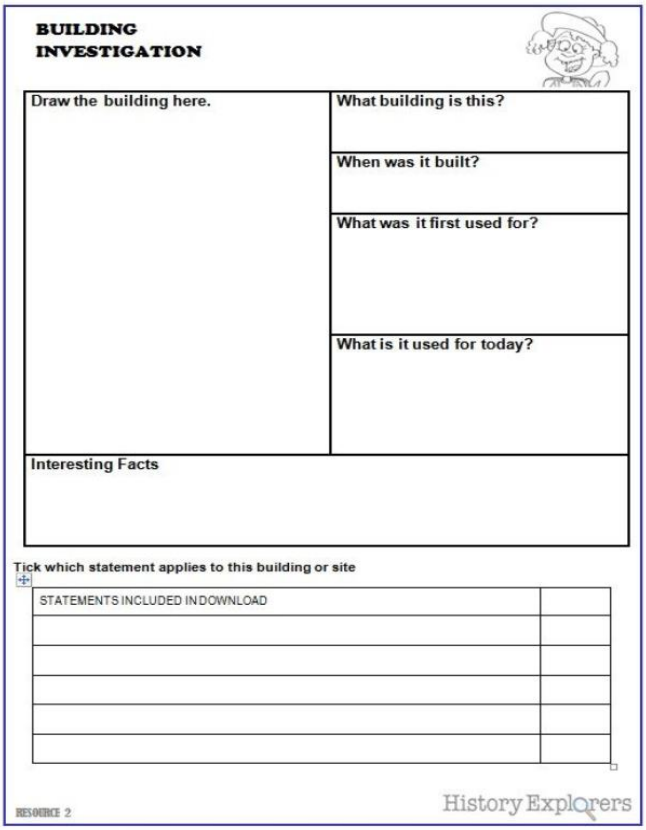
What is Checked Using a Building Preventive Maintenance Checklist?

The following are the 7 main sections of a building preventive maintenance checklist used for regularly inspecting buildings:

- Lighting
- Electrical
- Safety
- HVAC
- Building Interior
- Building Exterior
- Plumbing



Checklist Form Templates



BUILDING INVESTIGATION

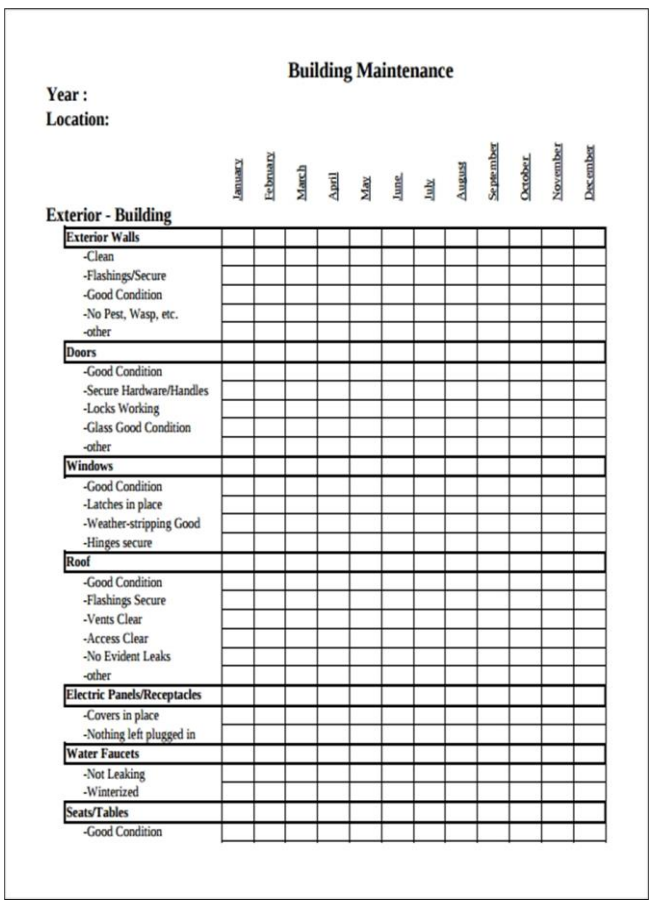
Draw the building here.	What building is this?
	When was it built?
	What was it first used for?
	What is it used for today?
Interesting Facts	

Tick which statement applies to this building or site

STATEMENTS INCLUDED IN DOWNLOAD	

RESOURCE 2

History Explorers

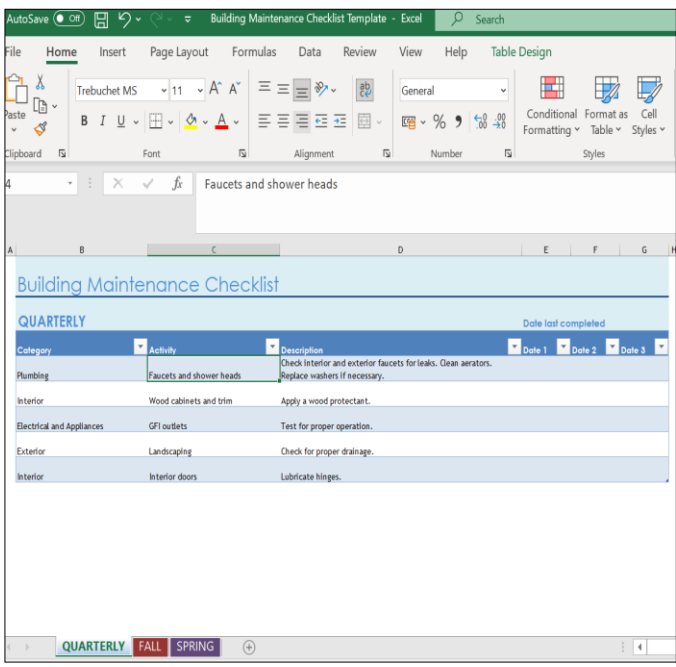


Building Maintenance

Year :

Location:

Exterior - Building	January	February	March	April	May	June	July	August	September	October	November	December
Exterior Walls												
-Clean												
-Flashings/Secure												
-Good Condition												
-No Pest, Wasp, etc.												
-other												
Doors												
-Good Condition												
-Secure Hardware/Handles												
-Locks Working												
-Glass Good Condition												
-other												
Windows												
-Good Condition												
-Latches in place												
-Weather-stripping Good												
-Hinges secure												
Roof												
-Good Condition												
-Flashings Secure												
-Vents Clear												
-Access Clear												
-No Evident Leaks												
-other												
Electric Panels/Receptacles												
-Covers in place												
-Nothing left plugged in												
Water Faucets												
-Not Leaking												
-Winterized												
Seats/Tables												
-Good Condition												



AutoSave Off — Building Maintenance Checklist Template - Excel — Search

File Home Insert Page Layout Formulas Data Review View Help Table Design

Trebuchet MS 11 — General — Conditional Formatting — Format as Table — Cell Styles

Clipboard Font Alignment Number Styles

Faucets and shower heads

Building Maintenance Checklist

QUARTERLY — Date last completed

Category	Activity	Description	Date 1	Date 2	Date 3
Plumbing	Faucets and shower heads	Check interior and exterior faucets for leaks. Clean aerators. Replace washers if necessary.			
Interior	Wood cabinets and trim	Apply a wood protectant.			
Electrical and Appliances	GFI outlets	Test for proper operation.			
Exterior	Landscaping	Check for proper drainage.			
Interior	Interior doors	Lubricate hinges.			

QUARTERLY FALL SPRING

Existing Building Inspection Guidelines

https://pdfslide.net/documents/garis-panduan-pemeriksaan-dan-penilaian-keadaan-bangunan.html

GARIS PANDUAN
PENYENGGARAAN BERJADUAL
BANGUNAN KERAJAAN

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https://www.yumpu.com/id/document/read/48845260/kaedah-pemeriksaan-bangunan-1

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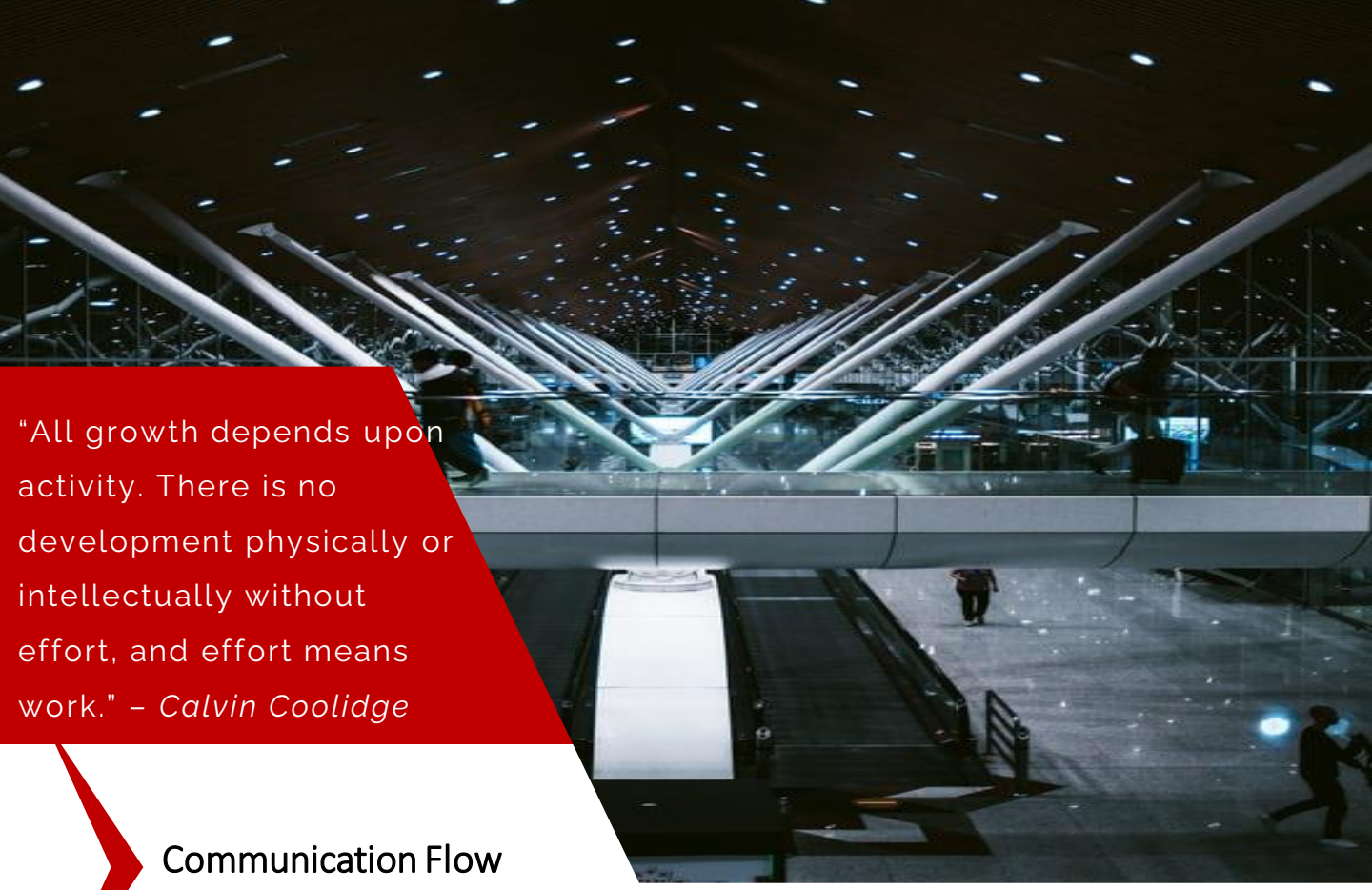
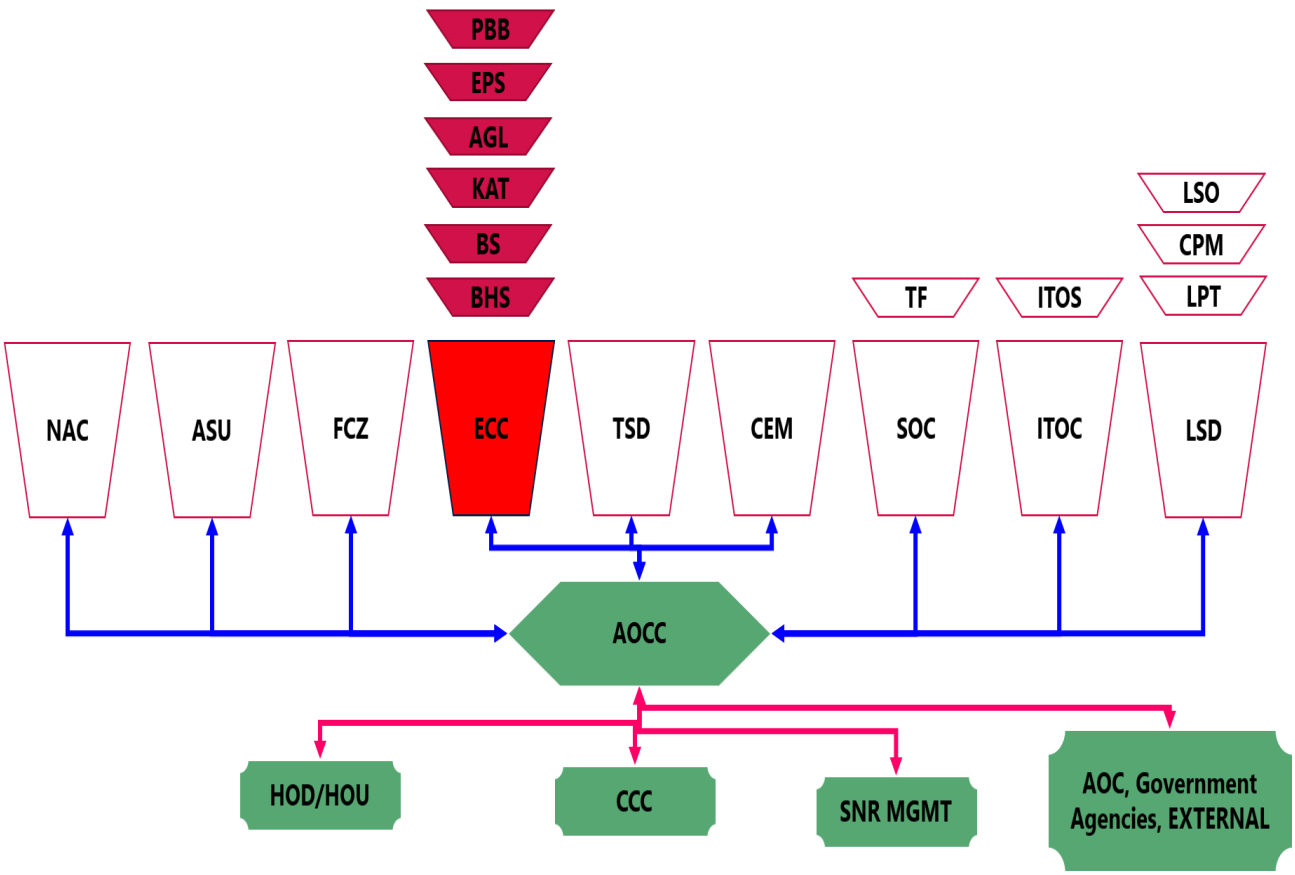


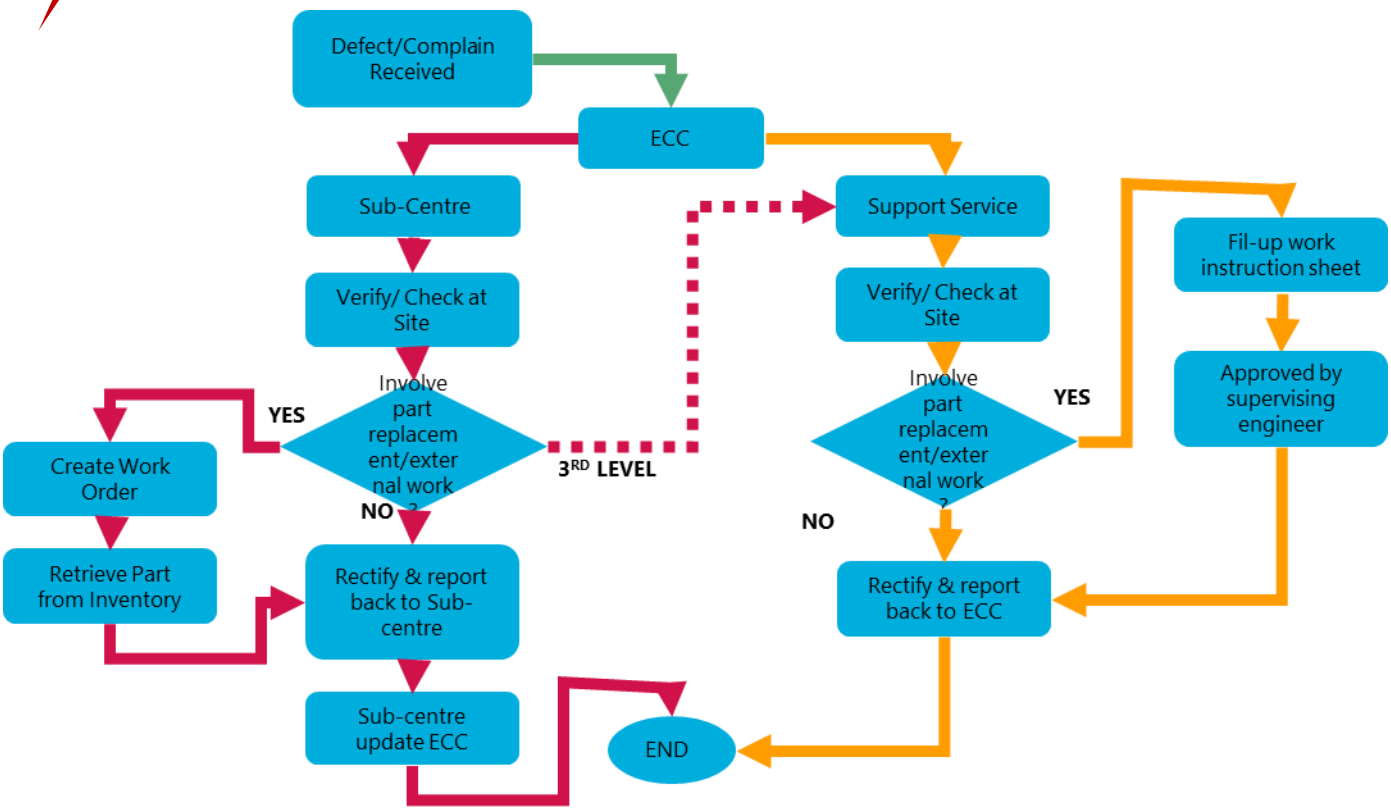
"All growth depends upon activity. There is no development physically or intellectually without effort, and effort means work." – *Calvin Coolidge*

Communication Flow



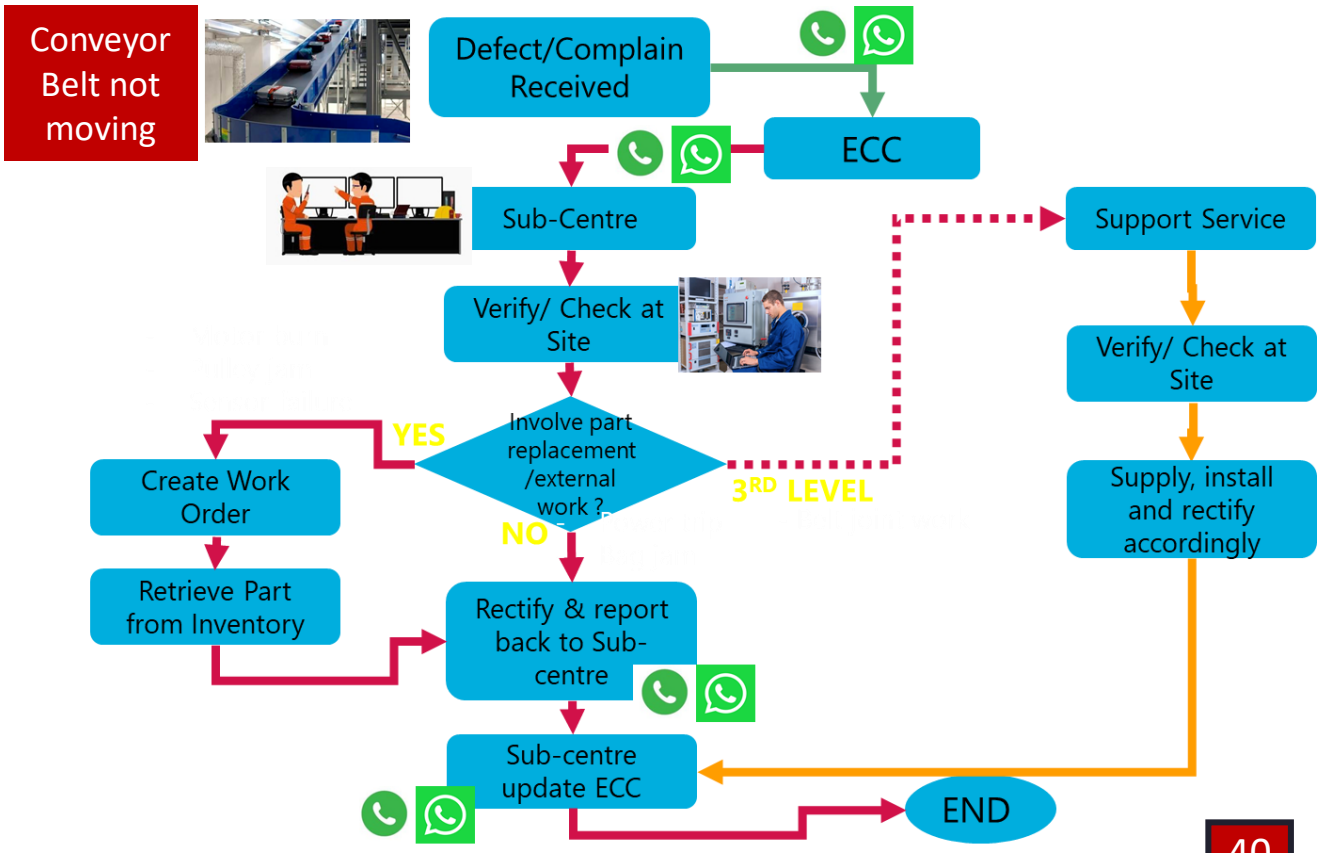
The power of imagination makes us infinite." - *John Muir*

Communication and Work Flow



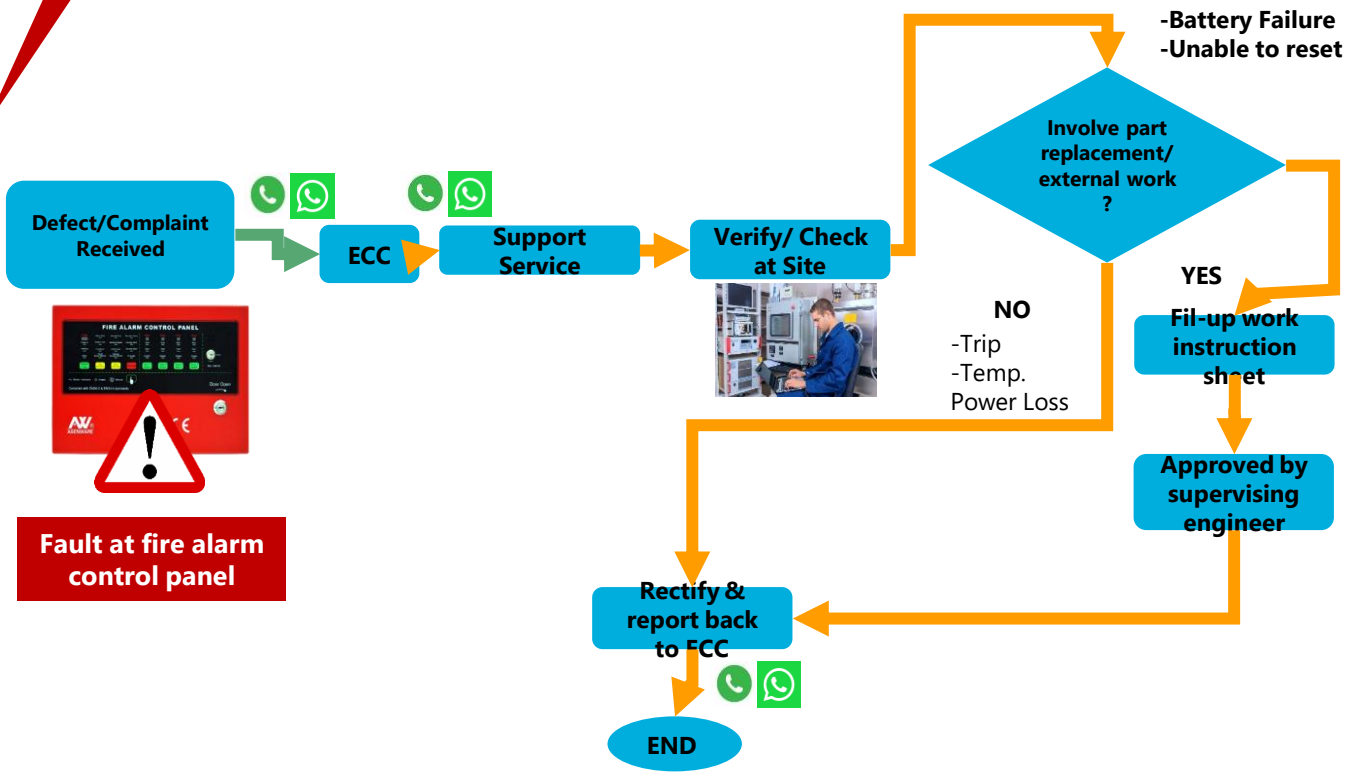
"Limitations live only in our minds. But if we use our imaginations, our possibilities become limitless." - *Jamie Paolinetti*

Example Communication & Work Flow In House Maintenance

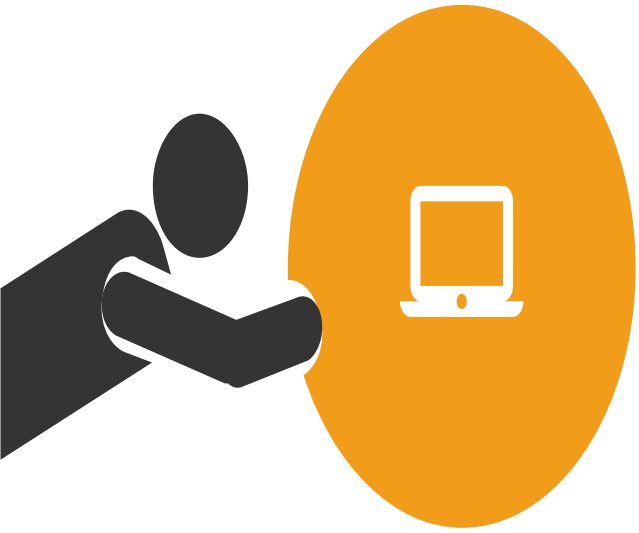


"Start where you are. Use what you have. Do what you can." – *Arthur Ashe*

Example Communication & Work Flow – Out-Source Maintenance



Do your exercise



1. List Six Process to Managing Defects in New Buildings

2. List 3 Types Of Maintenance Logs

CHAPTER 2
REFERENCES

Abdul Lateef Olanrewaju, Arazi Idrus and Mohd Faris Khamidi Investigating building maintenance practices in Malaysia: a case study Department of Civil Engineering, Universiti Teknologi Petronas, Tronoh, Malaysia

Anthony, L. T.,(2013). *New buildings could also have structural defects.* [Online] Available at: http://www.themalaymailonline.com/malaysia/article/new- buildings-could-also-have-structural-defects

Frank Gatlin, A. N., 2013. Navigant. Identifying & Managing Design and Construction Defects.

Garispanduan Pemeriksaan dan Penilaian Keadaan Bangunan Sediada, Bahagian Senggara Fasiliti Bangunan Cawangan Kejuruteraan Senggara Ibu Pejabat JKR Malaysia

https://ftmaintenance.com/maintenance-management/what-is-maintenance-management/

http://www.drfixitinstitute.com/download/rebuild_2010/Rebuild%20vol%204%20no%202%20Apr-Jun%202010/Rebuild%20vol%204%20no%202%20Apr-Jun%202nd.pdf

Kamaruzzaman, S.N., Zawawi, E.A. and Omar, A. (2011). "Preliminary evaluation of problems involved in maintaining heritage buildings in Malaysia." The Professional Journal of the Institution of Surveyors, 46(1); pp. 30-38

Kayan, B.A. (2020). Green Maintenance of Heritage Buildings A Sustainable Repair Approach. University of Malaya Press Kuala Lumpur.

Malaysia Airport Holdings Berhad.

Minter, E. (2016). Defects Liability period. [Online] Available at:

http://www.constructionlawmadeeasy.com/Defectsliabilityperiod

CHAPTER 3

MAINTENANCE WORK REPORT

Define maintenance work report term such as request record, building inspection record, maintenance work record, and Computerized Maintenance Management System (CMMS)

"You can't change how people treat you or what they say about you. All you can do is change how you react to it"

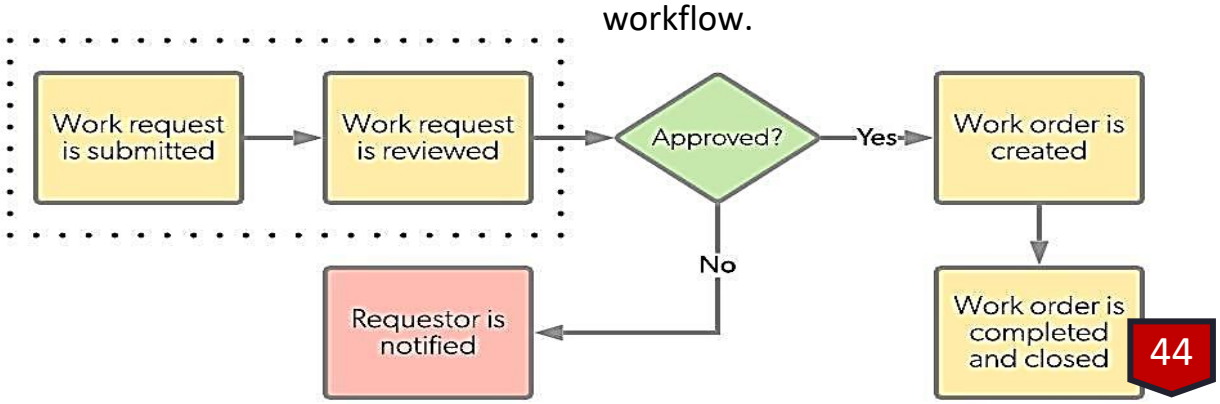
- Mahatma Gandhi

CLICK TO LEARN MORE

Work Request

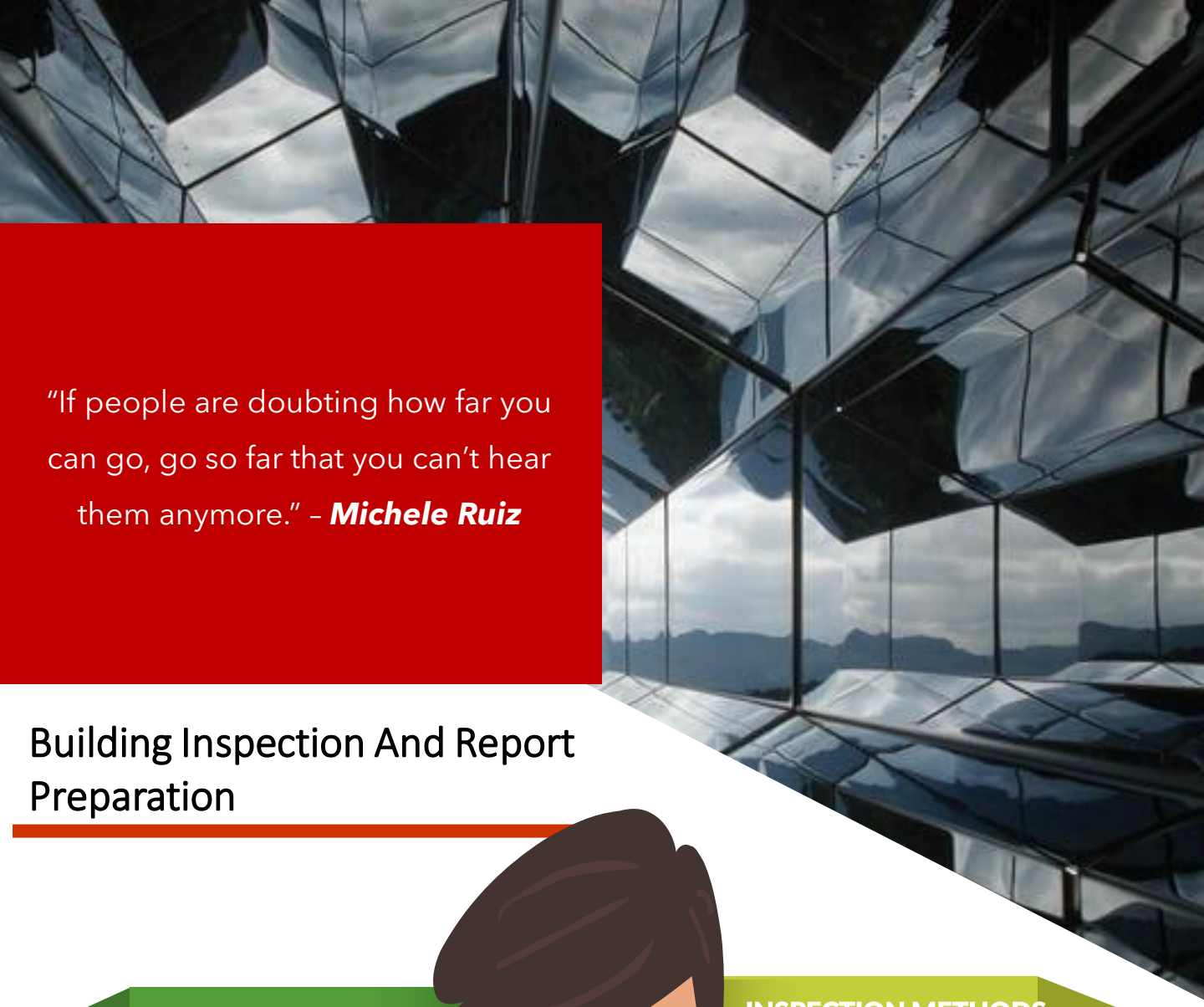
A work request is a formal document (digital or paper) that describes maintenance work that needs completed. A work request is the identification of work needed, issued by the customer to the maintenance department.

- The maintenance department is home to workers that are skilled in the maintenance organization of facilities, grounds, equipment, vehicles, and other assets. They are the caretakers of property and, as a result, support a variety of customer needs. These needs can quickly add onto regular, scheduled work such as routine cleaning and preventive maintenance. In order to manage and validate all tasks, maintenance must operate with a clear workflow.



Building Inspection

A **building inspection** is an inspection performed by a **building inspector**, a person who is employed by either a city, township or country and is usually certified in one or more disciplines qualifying them to make professional judgment about whether a building meets building code requirements. A building inspector may be certified either as a residential or commercial building inspector, as a **plumbing, electrical or mechanical inspector**, or other specialty-focused inspector who may inspect structures at different stages of completion. Building inspectors may charge a direct fee or a building permit fee. Inspectors may also be able to hold up construction work until inspection has been completed and approved



"If people are doubting how far you can go, go so far that you can't hear them anymore." – ***Michele Ruiz***

Building Inspection And Report Preparation

A

BUILDING INFORMATION

such as address, owner's name, building location, building age, year built, type of construction, height and area of the building, type of building and others.

B

INSPECTION METHODS

such as initial site survey, monitoring, defect inspection form, permission letter, supervision and visual inspection, and others

C

DEFECT INSPECTION FORM

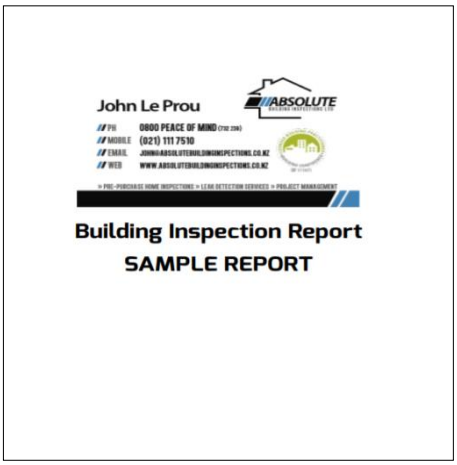
(refer to the example of defect inspection form or 'condition survey checklist').

D

INSPECTION REPORT

(refer to sample report content and sample report)

A basic building inspection report covers things like insulation and ventilation, all parts of the roof, and other components or parts of the building. After ta thorough inspection, the findings should be compiled in the report to make it easily understandable to the client. Generally, a building inspection is a visual inspection only; it may not identify some major structural defects or other hidden problems. But it is still a great way to find out if there are issues on the building and how to fix them before the purchase.



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https://www.absolutebuildinginspections.co.nz/uploads/sample.pdf

Example of report content

Part A : 1.0 Introduction

- 1.1 Background of property
- 1.2 Brief – A summary of client's instruction
- 1.3 Objectives of survey
- 1.4 Detail of property
- 1.5 General information on survey
- 1.6 Methods of surveys
- 1.7 Personnel
- 1.8 Limitations
- 1.9 The report

2.0 General Conditions of Elements

- 2.1 Roofs
- 2.2 Waterproofing
- 2.3 Internal plumbing, water tank, and sanitary appliances
- 2.4 Sewerage and drainage systems

3.0 Conclusion

Part B : Table of Condition – Summary

Condition survey checklist
Identification of defects

Part C : Estimated Cost for Rectification Works

Appendices : Defects Indication Plans & Building Plans

Example of report content

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- Condition survey checklist
- Identification of defects

Part C : Estimated Cost for Rectification Works

Appendices : Defects Indication Plans & Building Plans

Source :
En. Mat Rodzi Bin Abdul Raof
(ASSERTIVE OPTION SERVICES)

1 PART A

1.0 INTRODUCTION

1.1 Background of property

a) Client's Name : (*Tenant of the building*)
b) Building Owner : (*Name of building owner*)
c) Property Address : (*Location of the property*)
d) Types of building : Office building
d) Nos. of floor : 5– storeys with parking basement
e) Land area : 5,833.01 m²
f) Built-up area : 2,885.20 m²
g) Floor Area : 8,170.65 m²
h) Building height : 27 m
i) Types of construction: Reinforced concrete columns and beams
j) Building specifications: (as shown in table below)

Items	Building specification
Type of roof	Pitched roof (25°) Timber trusses Colour-bonded metal decking roof covering with fiber wool insulation, aluminium foil, and chicken netting
Walls	Using in-situ reinforced concrete structures, plastered brickwork external walls, lightweight internal gypsum board partitions and painted by emulsion paint finish.
Ceiling	Suspended gypsum board
Services	Cold water supply system with roof top tank (7200 gallons) supported by water pumps and galvanized iron piping to toilets and sanitary appliances
Drainage	The surface water drainage is built with reinforced concrete gutter at the roof top completed with uPVC rain water down pipes (10nos.) built in main columns and channeled through the water sumps and outside main drains
Miscellaneous	A swimming pool is located at the second floor. It has an area of 343.89m² and carries a huge volume of water.

Source :
En. Mat Rodzi Bin Abdul Raof
(ASSERTIVE OPTION SERVICES)

Cont'..PART A

1.2 Brief – A summary of client's instruction

In accordance to the client's instructions on 25th January 2007, we have inspected the subject property and hereby attached the report on the property's general construction, condition, problems, causes and possible remedies.

1.3 Objectives of the survey

The objectives of the survey are:-

- To carry out building audit and inspection on specific elements and as instructed by client.
- To identify deterioration, problems at roof elements, problems of leaking of water plumbing, piping and tank, problems of waterproofing at toilet areas and basement, and to find out evidence of defects that occurred in the spaces covered under it.
- To identify problems of building air-conditioning system,
- To identify problems of building electrical system,
- To prepare report of the inspection.
- To evaluate and prepare the cost of rectification.

1.4 General Information on Survey

The inspection has been carried out within 4 days. The main purpose of the survey is to acknowledge client about the condition of the building by identifying the defects and advice the correct rectifying action to be taken.

The surveys only focus on condition of the following elements:-
a) Roof trusses and covering,
b) Waterproofing at toilet and basement,
c) Cold water plumbing system, and sewerage system,
d) Electrical system,
e) Air-conditioning and ventilation system.

Upon completion of the survey, a comprehensive report will be given to the client. The report will provide information about the defects of the structure and its elements. It includes the suggestion for the possible remedies. The report will also give recommendations and advice to client to the correct rectifying action to be taken.

Source :
En. Mat Rodzi Bin Abdul Raof
(ASSERTIVE OPTION SERVICES)

Cont'..PART A

1.5 Methods of survey

The survey is based on visual inspections only and no structural investigation or testing carried out by building inspectors to identify the defects and the problems.

The equipments that have been used during the inspection are:-

a) *a digital camera with flash attachment* – to take photograph of subject property or defect identification to provide visual evidence.
b) *powerful torch light* – needed for roof spaces and other dark areas,
c) *plans and checklist* – to write down the important point or any sketches during survey, and
d) *measuring tape* – to measure a length of defects.

1.6 Personnel

The inspection was carried out by **AQR *Training & Consulting's*** building auditor, En Mukhtar bin Mat Ali on 22nd, 23rd, 25th February 2007 and 7th March 2007 in dry and rainy weather conditions.

1.7 Limitations

1) At the time of inspection, the building was occupied.

2) The inspections were limited and only focused on roof trusses covering & waterproofing, electrical system, air-conditioning & ventilation system, and internal plumbing & sewerage system.

3) No disruptive investigation work has been carried out involving the cutting or plasterer on concrete. There maybe, a number of elements where we cannot give comment such as dampness appeared on concrete ceiling and floor slab surfaces.

4) No scientific equipment, electronic equipment was used to perform the relevant test. Most of defects were identified by visual inspection, and testing of any parts of elements perform by touching and it effect.

Source :
En. Mat Rodzi Bin Abdul Raof
(ASSERTIVE OPTION SERVICES)

Cont'..PART A

1.8 The report

The types of defects identified are shown in condition survey checklist and photo (as shown in Part B) which include the photos of each defect. The location of defects can be referring at defect's indication plan as appendix. This report also included the estimated cost for rectifying each defects in Part C.

This report does not include the inspection report for air-conditioning and ventilation system, and electrical system which shall be submitted within 3 weeks after this submission.

To prepare the complete report, necessary permission is required from the neighbour to proceed with further investigation. It also depends on client's requirement and information given to us.

2 PART B

2.0 GENERAL CONDITION OF THE ELEMENTS

This section explains the general condition of each element inspected with reasonable proposals of remedies. The detail specification of material and workmanship are spelled-out in costing's section.

The defects were identified and classified under different state of condition as follows:-

A – Danger to occupants (hazardous: affect safety and health of the occupants)
B – Not to specification (problems of design or unsuitability used of materials)
C – Need immediate action (to avoid further deterioration and unnecessary costs for repairing)
D – Fair (minor defects but may need further monitoring)
E – Good (functional, sound)
F – To be rectified at specific time (to carry out repair work base on planning)

Source :
En. Mat Rodzi Bin Abdul Raof
(ASSERTIVE OPTION SERVICES)

cont' PART B

2.1 Waterproofing

The failures of waterproofing system usually result in leaking and dampness. From the inspection, we noted that these defects appeared at concrete slab, beam and floor at some places of basement, roof space and toilets.

Clogging of rain water down pipe causes overflow through leaks (holes) at reinforced concrete gutter (holes) and cause dampness to internal roof space. Some dampness can also be seen on ceiling board at 2nd floor toilet and ground floor that is caused by leaking through concrete cracks and joints.

At basement, penetration of ground water through cracks of concrete floor slab causes water on concrete surface to continue to flow all the time due to constant pressure underneath the floor. Dripping of water through upper level concrete slab also causes dampness on floor.

Recommendation

There are 3 proposals of rectification for waterproofing problems in the basement. Installation of damp proof membrane will be very costly. The easiest is to form grooves at the floor slab of minimum width and depth for diverting the flowing water to the existing drain and water sump.

Sipping and dripping of water from the concrete floor at toilets can be seen at the surface of cracks. Work done previously to stop leaking seemed to have solved the problems. The leaking is minor and can be rectified as specified such as to hack-off existing tile and cement base and reinstall water-proofing before retiling including ponding test.

Water sipping and dampness problems at the concrete ceiling required further investigation (that may involve necessary testing and excavation) in order to identify the actual sources of water penetration. However, the defect is considered minor unless there is an indication of cracks at concrete beams and floors.

Source :
En. Mat Rodzi Bin Abdul Raof (ASSERTIVE OPTION SERVICES)

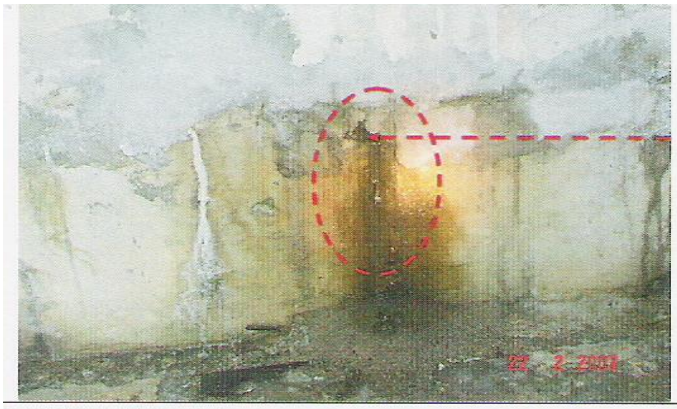
cont' PART B

TABLE OF CONDITION – SUMMARY OF REPAIR COST

Condition Survey
Building:
Address:

No.	Element/Item	Unit	Quantity	Condition	Cost	Total	Remarks
A.	*ROOF*						
	Metal roof covering	m²	2	C	35.00	70.00	Supply and install new roof sheeting
	Metal Flashing	m	1	C	10.00	10.00	Clear-off existing sealant and apply new
	Metal Flashing	m	4	C	30.00	120.00	Remove and replace new
	Roof trusses	Nos.	1	A	4.00	4.00	Supply and fix with new bolts and nuts
	R.C. Gutter and rain water down pipe	Nos.	3	C	250.00	250.00	Clear debris from gutter and RWDP, and testing
	R.C. Gutter and rain water down pipe	Lump sum	Lump sum	C	100.00	100.00	Remove wild plant and apply weed killer
	Reinforced concrete gutter	Nos.	2	C	10.00	20.00	Apply concrete grouting
	Water tank overflow pipe	m	21	B	40.00	840.00	Supply and install additional overflow pipe
	uPVC ventilation pipe	Nos.	5	C	25.00	125.00	Clear-off existing sealant and apply new
	PVC Floor trap	Nos.	5	B	50.00	250.00	Hack-off concrete base and install new floor trap
	uPVC overflow pipe	Nos.	3	C	30.00	90.00	Remove and make good
B.	*WATERPROOFING*						
	Basement concrete floor slab	m²	1417.29	C	28.00	39,684.12	Supply and install waterproofing membrane
	Basement wall	m²	625.51	C	15.00	9,382.60	Scrap-off, and apply waterproofing painting
	3rd Floor toilet concrete floor slab	m²	1	C	250.00	250.00	Hack-off tiles and apply waterproofing
	1st floor concrete floor slab	Lump sum	Lump sum	C		300.00	Hack-off tiles and apply waterproofing
C.	*INTERNAL PLUMBING &*						
	SANITARY APPLIANCES						
	Wash Hand basin	Nos.	4	C	3.00	12.00	Clear clogging and repair
	Water Closet	Nos.	1	C	10.00	10.00	Apply and fix new screws
	Flushing	Nos.	1	C	5.00	5.00	Supply and replace new hook
	Ground conduit and waste pipe	Lump sum	Lump sum	C		3,000.00	Locate piping, excavate ground and repair
D.	*MISCELLANEOUS*						
	Air-conditioning support frames	Nos.	2	A	100.00	100.00	Supply and replace existing support frames
	False work (ceiling board)					500.00	Supply and replace existing ceiling board, etc.
	Preliminaries (5%) and site clearing (2%)	Lump sum				3,858.59	
	Scaffolding (2%)	Lump sum				1,102.45	
	TOTAL					**60,083.76**	

IDENTIFICATION OF DEFECTS



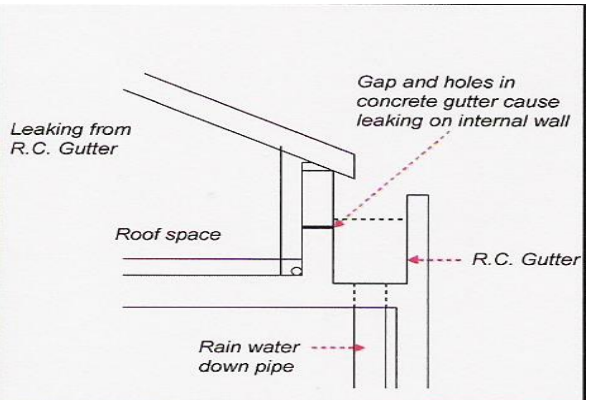


PHOTO NO : P7
REFERENCE NO : A13

ELEMENT	Reinforced Concrete Gutter
LOCATION	Internal Roof space
DEFECT	Leaks through concrete gutter (holes).
CONDITION	C – Need immediate action
CAUSES	Construction and clogging of rain water down pipe cause overflow through gaps and holes.
REMEDIES	Clear gutter and RWDP of clogging and seal-off concrete gaps with concrete grouting.

Source :
En. Mat Rodzi Bin Abdul Raof
(ASSERTIVE OPTION SERVICES)

3 PART C

ESTIMATED COST FOR RECTIFICATION WORKS

Project : Building And Facilities Audit
Element : Waterproofing

Item	Work Description	Unit	Quantity	Price Rate	Total (RM)
B5	Basement concrete floor slab *Proposal 1* Carry out injection grouting at all the paths of water penetration at concrete slab basement include all necessary works.	Lump sum	Lump sum	3,000.00	3,000.00
	Proposal 2 Supply and install waterproofing membrane to general surfaces concrete floor basement covered with cement and sand rendering 75 mm thick including all necessary works.	m²	1417.29	28.00	39,684.12
	Proposal 3 Build water drainage i.e. to hack-off existing basement concrete slab 25 mm wide x 25 mm deep at 1:100 fall and make good of the surface (to divert flow of water to existing drainage and water sumps).	m	20	100.00	2,000.00
B6 & B8	Basement concrete wall Scrap-off, clean, prepare surface and apply 2 coats of water or weather resistant painting with water resistant paint to general surfaces of wall (observe dampness affect before proceed with painting to wall).	m²	625.51	15.00	9,382.65
B7	Air-well Basement concrete beam Scrap-off old paint, clean, prepare surface and apply 2 coats of weather resistant paint to general surfaces of beams.	m²	14.4	12.00	172.80
	Sub-total				**54,789.57**

Source :
En. Mat Rodzi Bin Abdul Raof
(ASSERTIVE OPTION SERVICES)

Maintenance Work Record

Maintenance record, as name suggests, is a document that includes information regarding each repair and maintenance work that is done on asset or equipment. In simple words, it keeps tracks of assets failures and repairs. It is one of best way to maintain health and safety management. It also improves asset management as such record includes information such as :

- Time and date when maintenance is required to be done.
- Type of maintenance required to be done.
- Asset details such as number, parts required, working condition, etc.
- Risk associated with it.
- Environment condition and its affect.

Why Keeping Maintenance Record Is Important ?

01 02 03 04 05

- **Prevent Expensive Repairs**
- **Increases Safety**
- **Replacing Equipment**
- **Reduce Labor Workload**
- **Manage Each Machine**

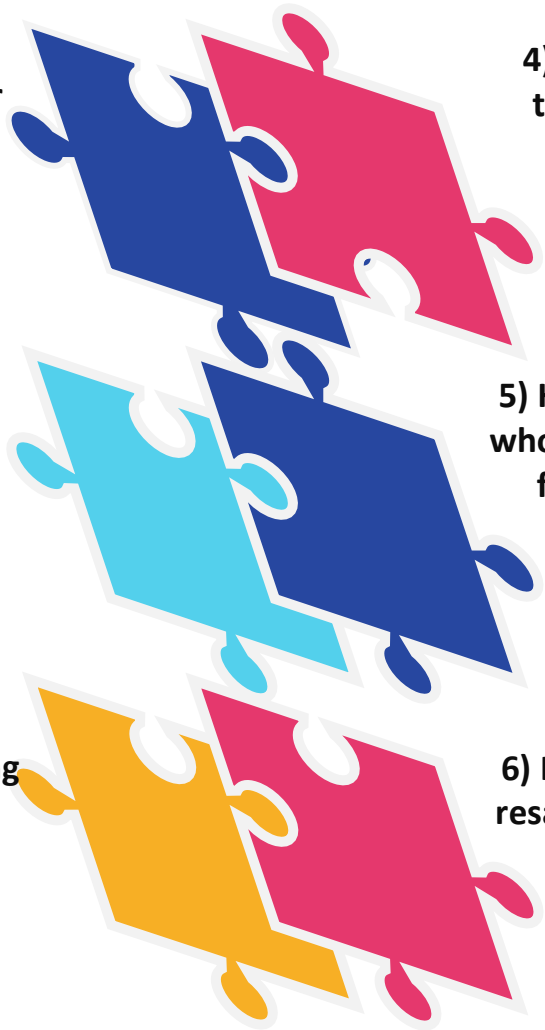
LEARN MORE CLICK HERE

6 Advantages Of Keeping An Equipment Maintenance Record

1) Prevent expensive repair works from happening

2) Helps you create specialised maintenance programs

3) Prevent problems regarding warranty claims



4) It increases the safety of operators

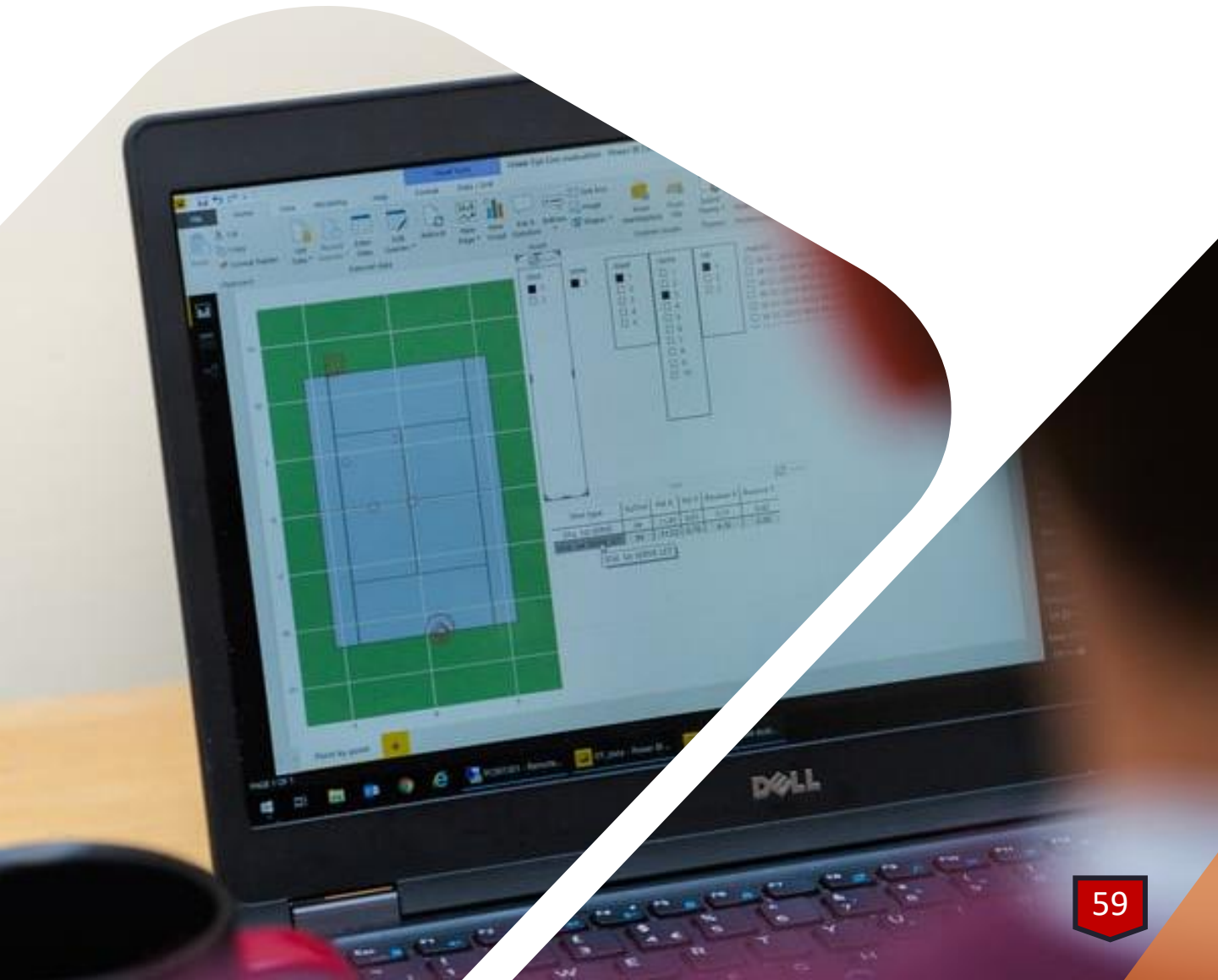
5) Helps you track who is accountable for a piece of equipment

6) It increases the resale value of the equipment

LEARN MORE

https://www.felix.net/project-news/6-advantages-of-keeping-an-equipment-maintenance-record

Computerized Maintenance Management System (CMMS)



The Importance Of CMMS Software In Maintenance 4.0

The high costs of the equipment essential to the production and the demand for high-quality products make it necessary to have maintenance capable of providing high equipment availability, production quality, and safety throughout the production cycle. For this to happen, it is essential to use technology capable of reducing maintenance costs, increasing the availability of assets, and improving technical teams' safety through interventions at the right time, before shutdowns or breakdowns occur.

Maintenance management systems, such as the CMMS (Computerized Maintenance Management System) software, ensure the global control of maintenance operations and are an excellent ally for companies in any industry.

CMMS software plays a crucial role in combining preventive and corrective maintenance plans since it allows managers to monitor the entire stock of equipment and assets by establishing and controlling the corrective or preventive maintenance plans. Despite the apparent advantages of preventive maintenance, there is equipment that, by nature, must be associated with corrective maintenance plans.

For companies that are not yet using intelligent technology, the CMMS solution allows them to organize, implement and control preventive and corrective maintenance plans, to provide a greater return on the investment made in equipment and assets. Using this tool, the maintenance department can work more intelligently and efficiently, thus increasing its productivity.

Centralizing all information related to the maintenance department in a maintenance management software (CMMS) is equally essential to achieve the investment's maximum profitability. This type of software allows not only to schedule maintenance operations alongside the production activities but also to obtain a global view of maintenance activity, equipment status, and intervention costs.

Therefore, we conclude that the significant profitability accelerator lies in technology and that companies must keep up with the new challenges and adapt to new technologies.

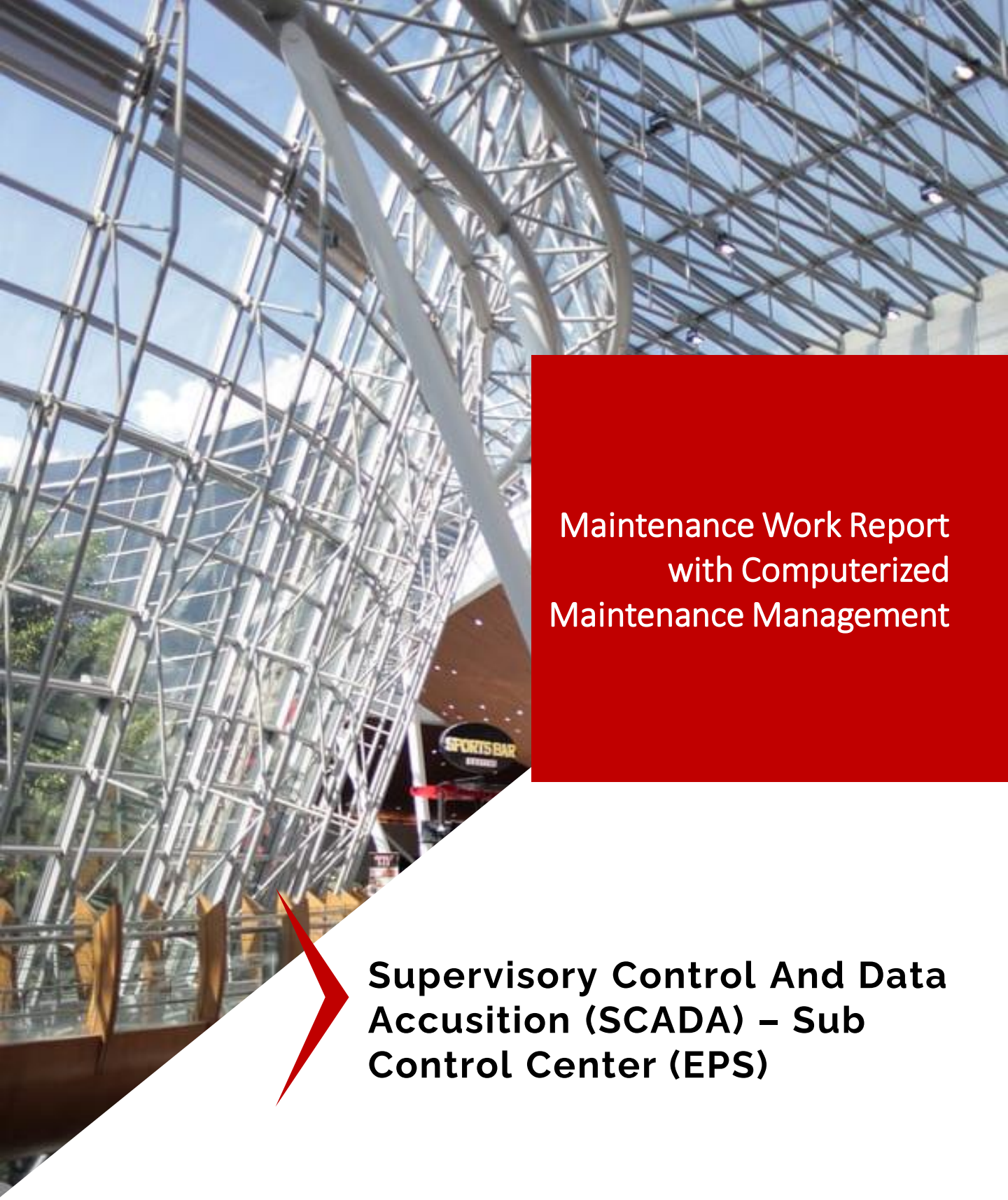
CLICK TO LEARN MORE

MONITORING & REPORTING SYSTEM

Maintenance Work Report with Computerized Maintenance Management

Case Study : KLIA (Kuala Lumpur International Airport)

- Supervisory Control And Data Accusition (SCADA) – Control Center
- Building Automation System
- BMS Mobile Expansion And Dashboard Customization For People Mover System
- SAP
- Smart Asset



Maintenance Work Report with Computerized Maintenance Management

Supervisory Control And Data Accusition (SCADA) – Sub Control Center (EPS)

Supervisory Control And Data Accusition (SCADA) – Sub Control Center (EPS)

The KLIA EPS Control Centre or KECC (also known as SCADA Control Room

Manned around the clock on a 24-hour basis, where each shift consists of one Executive Engineer and one Technical Officer.

Centralized monitoring and control minimize time of supply interruption and improved time of response in case of breakdown

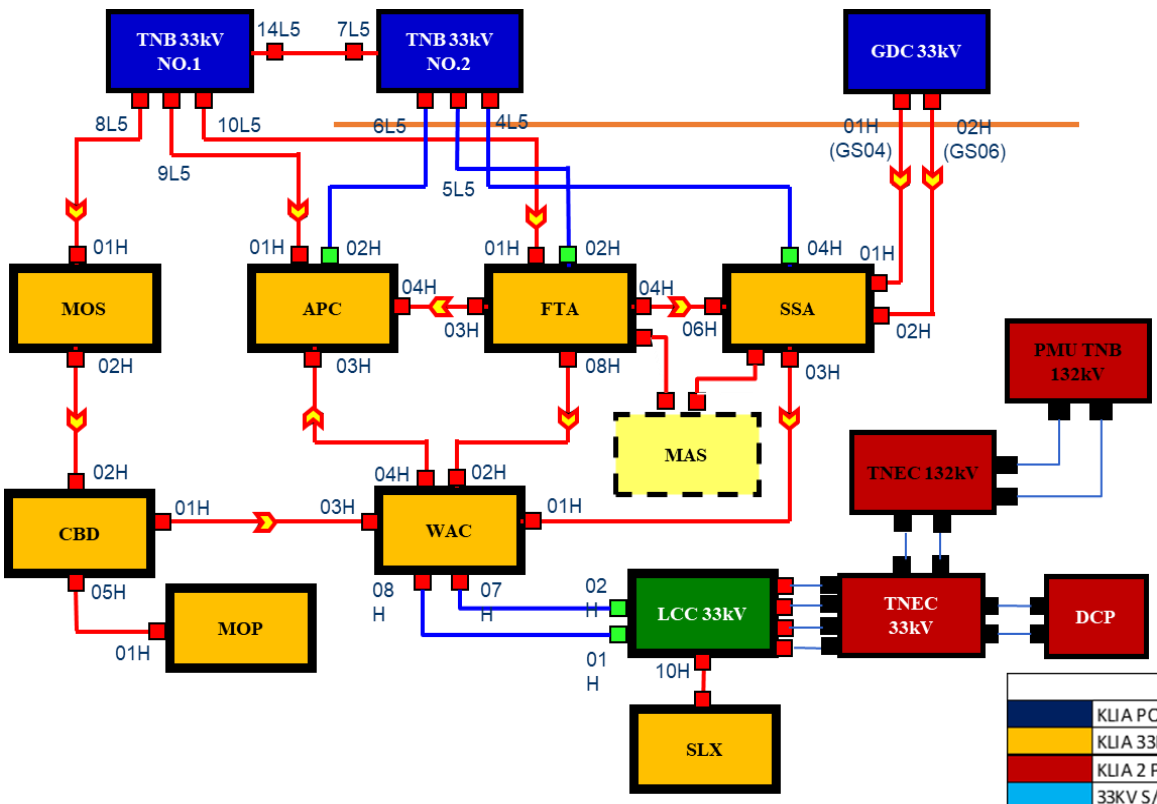
KLIA EPS consists of a closed ring 33kV system comprising of:

- TNB Main Intake 132/33kV Substation
- Gas District Cooling 33kV Substation and
- Seven (7) 33/11kV EPS Substation

An open ring 11kV system supplying a total of 59 Substation within KLIA.Centre able to remot control and monitoring of all KLI EPS substation as well as remote indications for other privatized 1 kV substation incoming and sect breakers.

KLIA EPS is responsible for the overall remote operations of the KLIA EPS 33 kV and 11 kV interconnected grid substations.

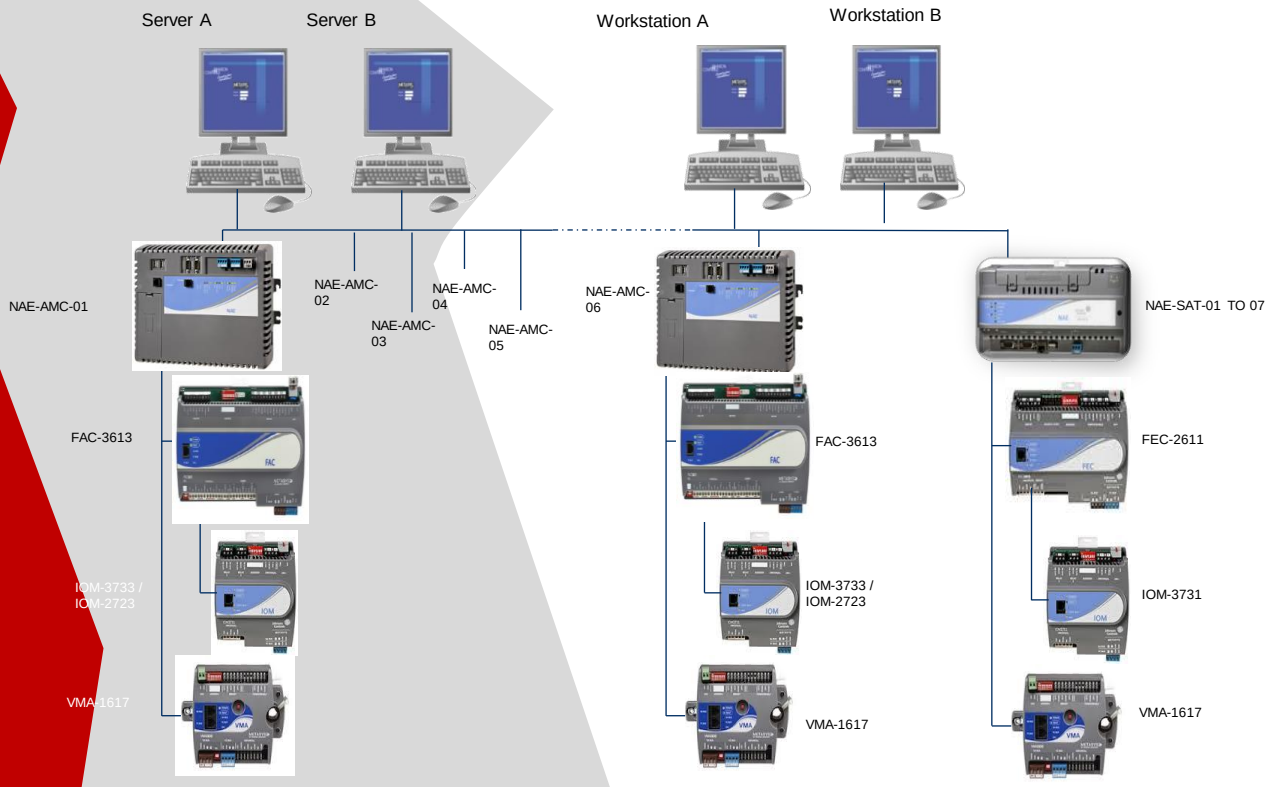
Supervisory Control And Data Accusition (Scada) – Sub Control Center (EPS)



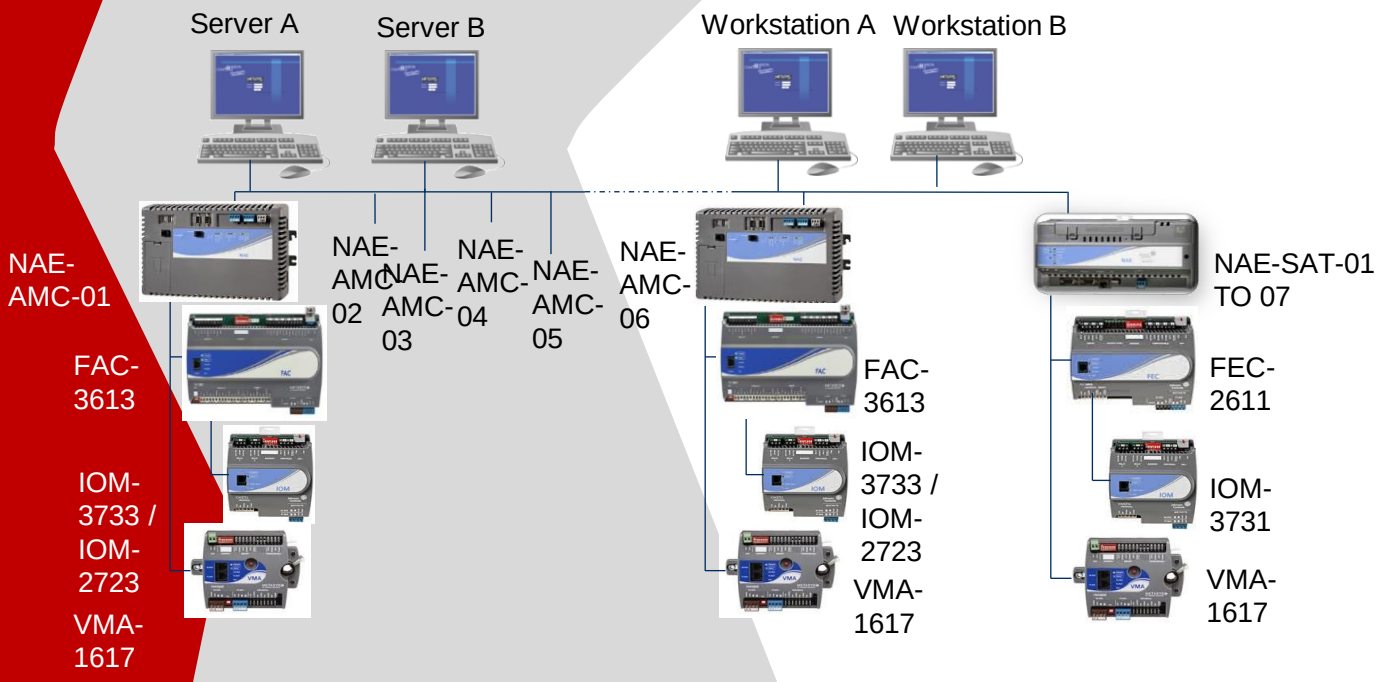
Maintenance Work Report with Computerized Maintenance Management At KLIA (Kuala Lumpur International Airport)

Building Automation System - Acmv Metasys Operation

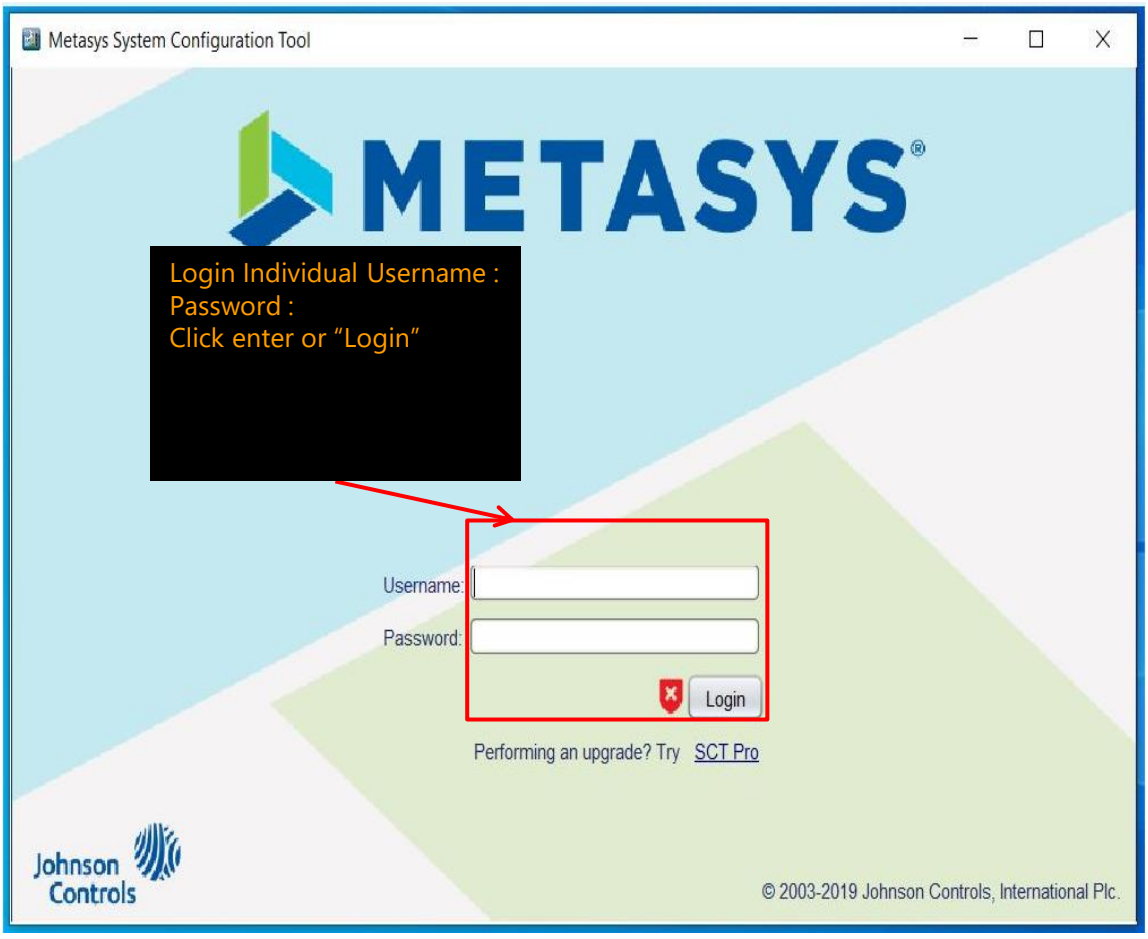
BUILDING AUTOMATION SYSTEM - ACMV METASYS OPERATION (ARCHITECTURE)



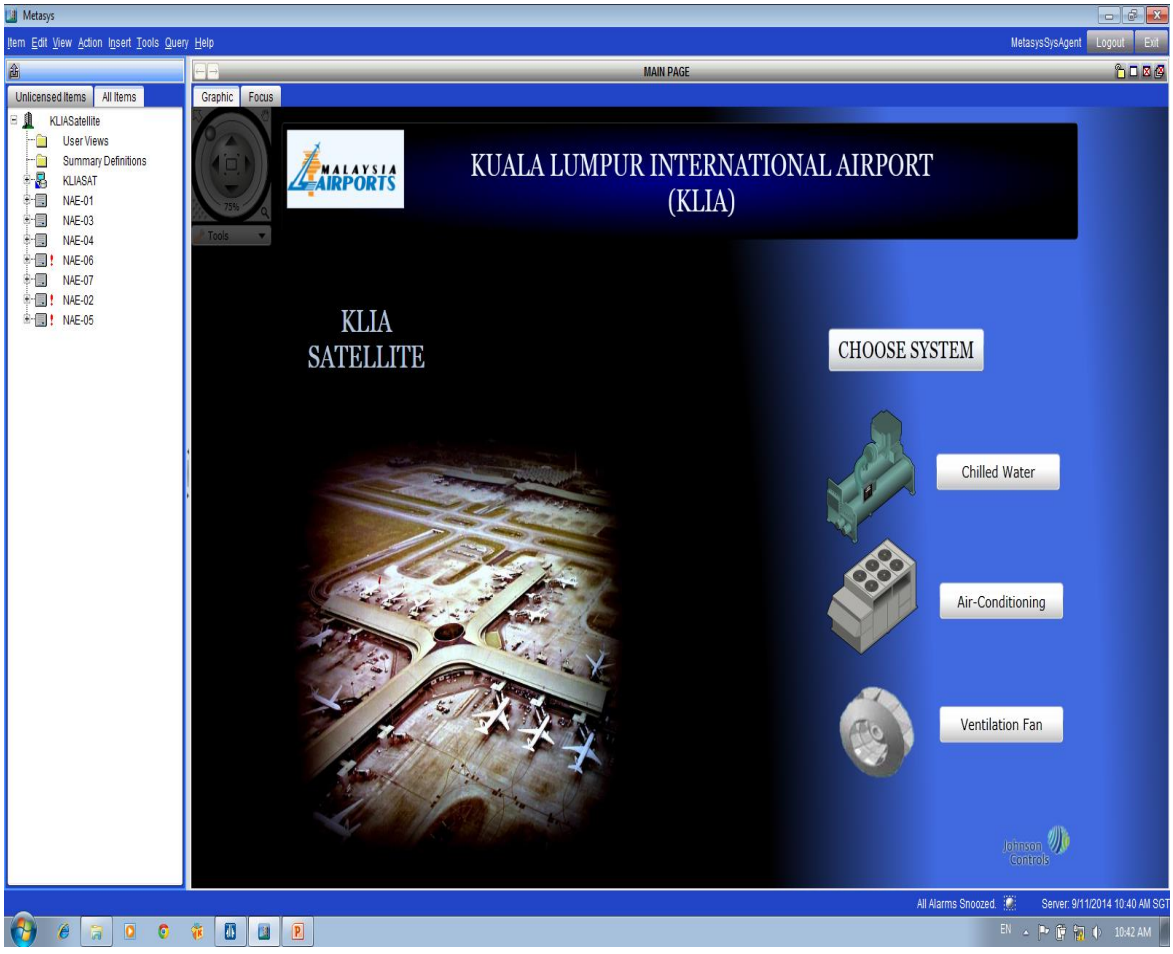
BUILDING AUTOMATION SYSTEM - ACMV METASYS OPERATION (ARCHITECTURE)



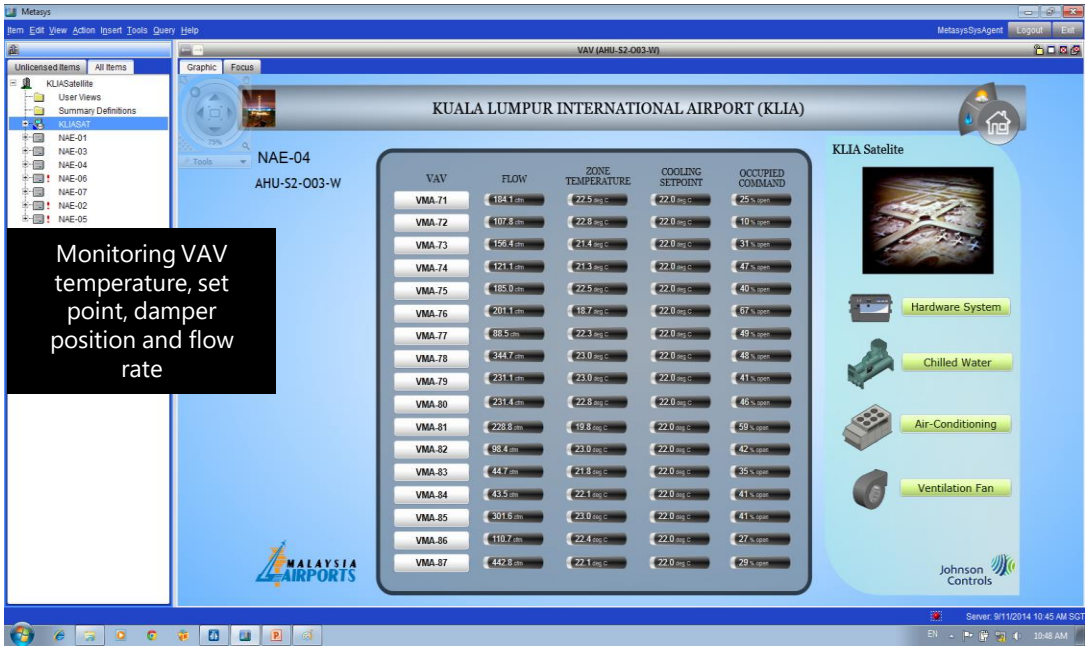
BUILDING AUTOMATION SYSTEM - ACMV
METASYS OPERATION (SYSTEM APPLICATION)

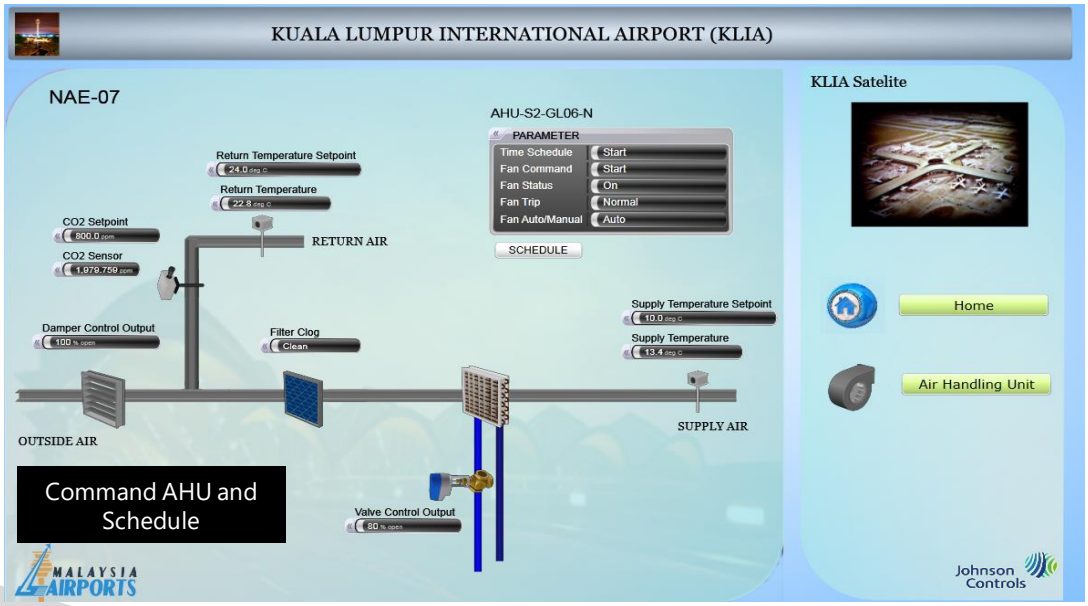


BUILDING AUTOMATION SYSTEM - ACMV METASYS OPERATION (SYSTEM APPLICATION)

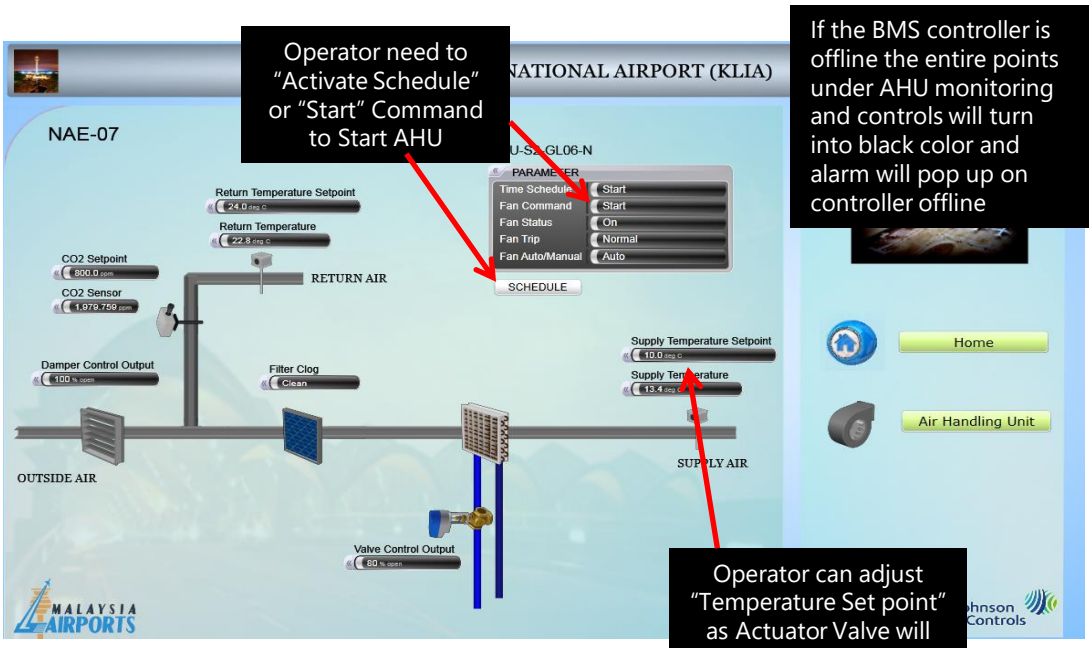


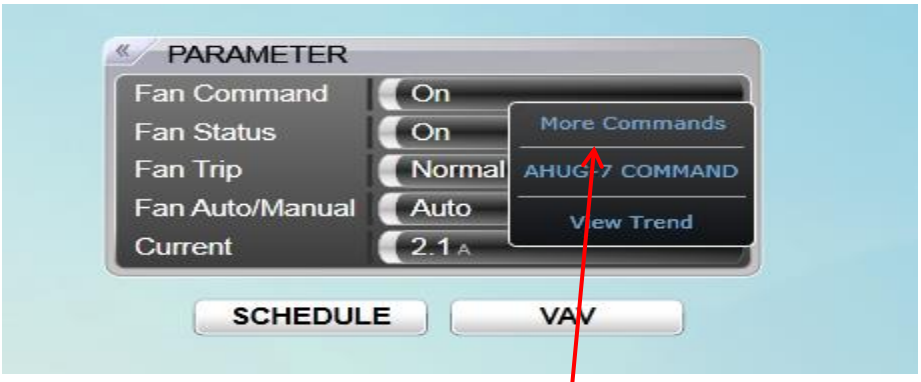
BUILDING AUTOMATION SYSTEM - ACMV METASYS OPERATION (SYSTEM APPLICATION)





BUILDING AUTOMATION SYSTEM - ACMV METASYS OPERATION (SYSTEM APPLICATION)

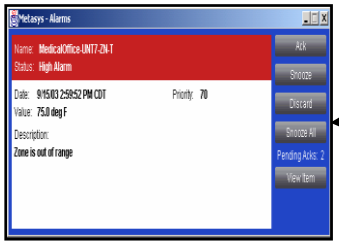




Left click for more command activity at the arrow pointer. Choose the "More Commands" to Start/Stop.

BUILDING AUTOMATION SYSTEM - ACMV METASYS OPERATION (SYSTEM APPLICATION)

Global alarm symbol in status frame will flash the color of the alarm status (RED or BLUE), suggesting the urgency to respond to alarm.



An alarm window is a graphic representation that occurs when a value in a supervisory controller (NAE) goes out of a user-defined range or fails to respond to a command within a specified time period. A change-of-state (COS) is detected and generates an event message.

Alarm Color Codes

Color	Description
Red !	Alarm
Blue !	Warning

The alarm windows pops up and displays the oldest, highest priority alarm message. As shown is type of indication alarm color codes.

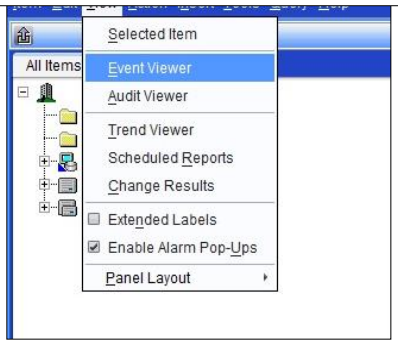
Alarm Commands

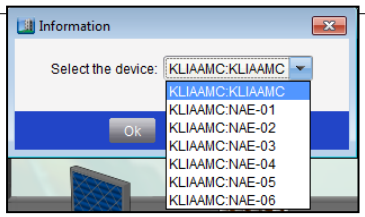
Several buttons are featured in the Alarms Window corresponding to commonly used commands:

Ack	Acknowledges events and stops the event from appearing on the Alarms Window.
Snooze	Sends the currently displayed alarm message away for 5 minutes, allowing any pending next highest events to appear in the Alarms Window. After 5 minutes, the alarm appears in the Alarms Window again (if it is the highest priority event).
Discard	Deletes the alarm with acknowledgement.
Snooze All	Puts the entire Alarms Window to sleep for 5 minutes. For the next 5 minutes, the Alarms Window disappears, even if high priority alarms or events occur.
Pending Acks	Shows the number of messages in the Event Queue.
View Item	Shows the Focus tab of the object in alarm in the Display Frame.

BUILDING AUTOMATION SYSTEM - ACMV METASYS OPERATION (SYSTEM APPLICATION)

Select View on the menu bar and click Event Viewer to browse through all the history alarm notification. You will be prompt for the device , choose the as KLIAAMC all the database points in the all NAE/NIE will revert back to the BAS Server.

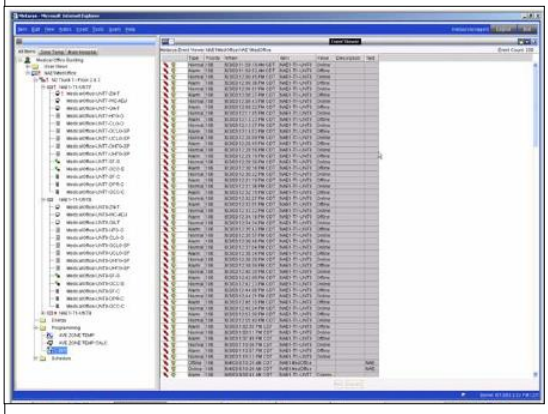




ALARM

The Event Viewer under View menu provides the means to retrieve and examine all of the messages stored in event repository. It allows operator to acknowledge and discard multiple event messages. As shown format of the event message in Event Viewer.

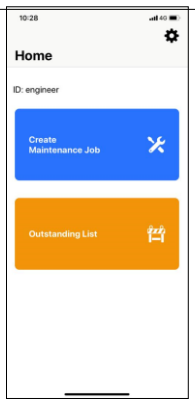
Icon	Description
	New event message occurring while the event view is open.
	Event message does not require acknowledgement.
	Event message requires acknowledgement.
	Event message has one annotation. Only shown with ADS or ADX.
	Event message has more than one annotation. Only shown with ADS or ADX.
	Event message has an associated graphic.



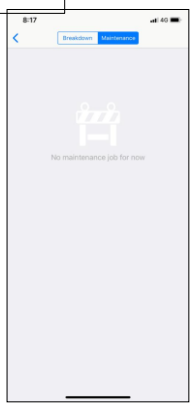
BUILDING AUTOMATION SYSTEM - ACMV METASYS OPERATION (SYSTEM APPLICATION)

PPM Activity

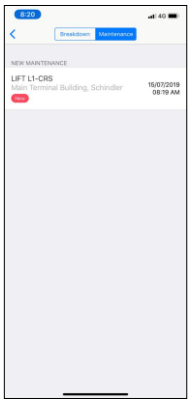
Open BSMS Mobile App



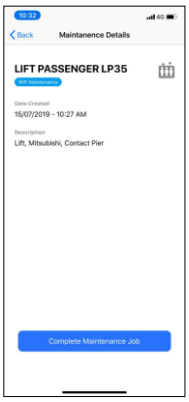
Log in username and password if necessary



Select create maintenance job

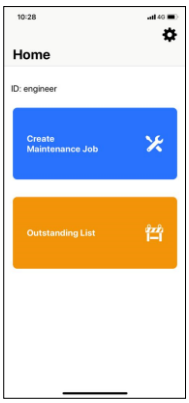


Maintenance job for equipment created

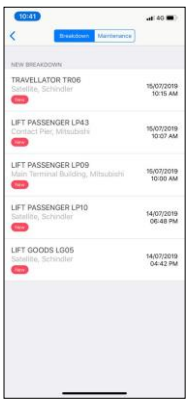


Scan QR code Pop out for action

Open BSMS Mobile App



Log in username and password if necessary



Select outstanding list

Select the necessary breakdown job

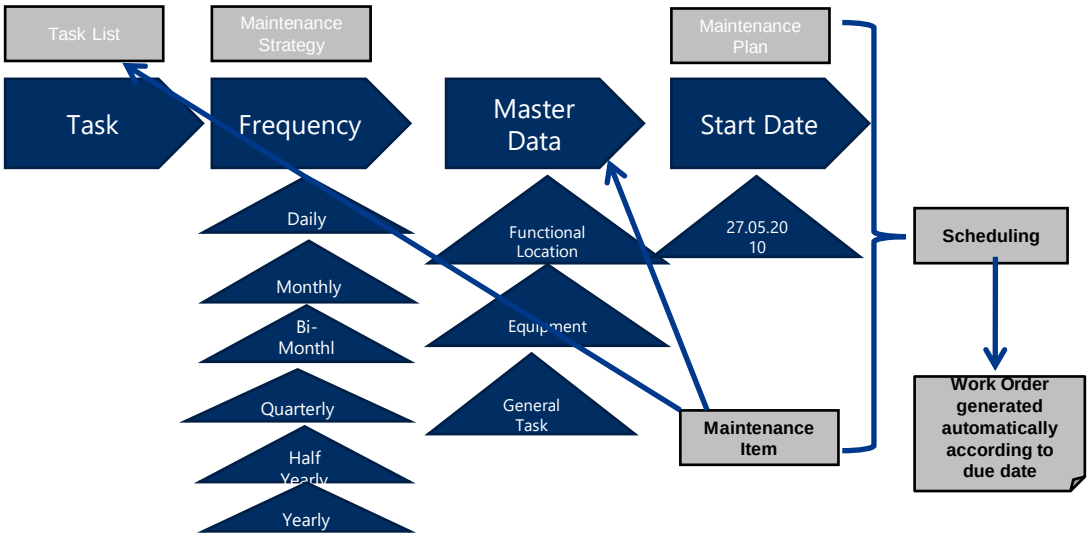
Click SOS Engineer to send notification to OEM

OEM will repeat the same step as breakdown job

Maintenance Work Report with Computerized Maintenance Management At KLIA (Kuala Lumpur International Airport)

SAP Plant Maintenance
Preventive Maintenance

SAP Plant Maintenance
Preventive Maintenance



SAP Plant Maintenance
Preventive Maintenance

Preventive Maintenance Process

Setup

- Create maintenance strategy
- Create task-lists
- Create maintenance plans
- Schedule maintenance plan

Planning

- Generate WO
- Plan resources:
  - ❖ Internal labor hours
  - ❖ External services
  - ❖ Spare parts

Scheduling

- Perform capacity evaluation
- Perform capacity leveling
- Release WO
- Print shop papers

Execution

- **Withdraw parts**
- **Execute work and record technical findings**
- **Return any unused parts**

Completion

- Accept vendor service
- Update notification
- Perform time confirmation
- Perform TECO
- Perform order verification
- Perform order settlement
- Perform business completion

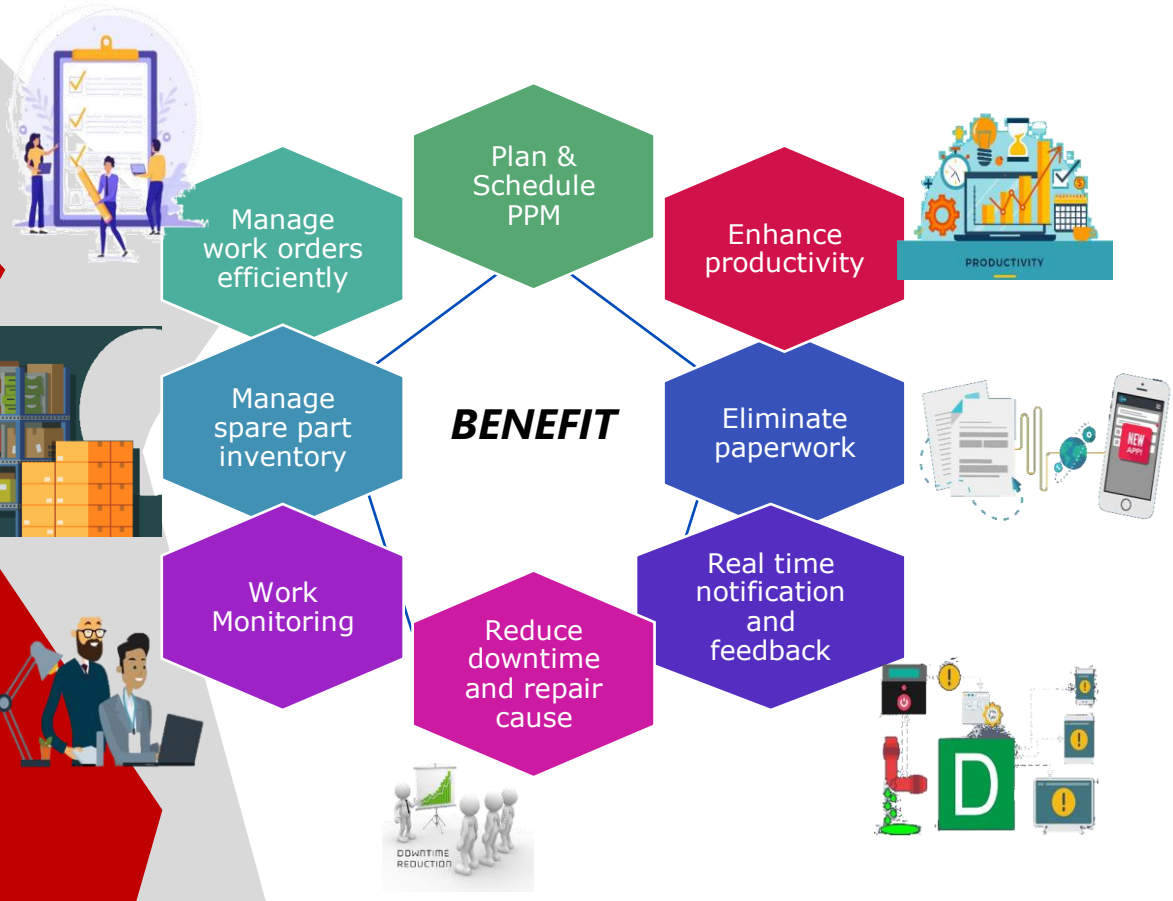
Legend: In SAP | Outside the system

Maintenance Work Report with Computerized Maintenance Management At KLIA (Kuala Lumpur International Airport)

SMART ASSET

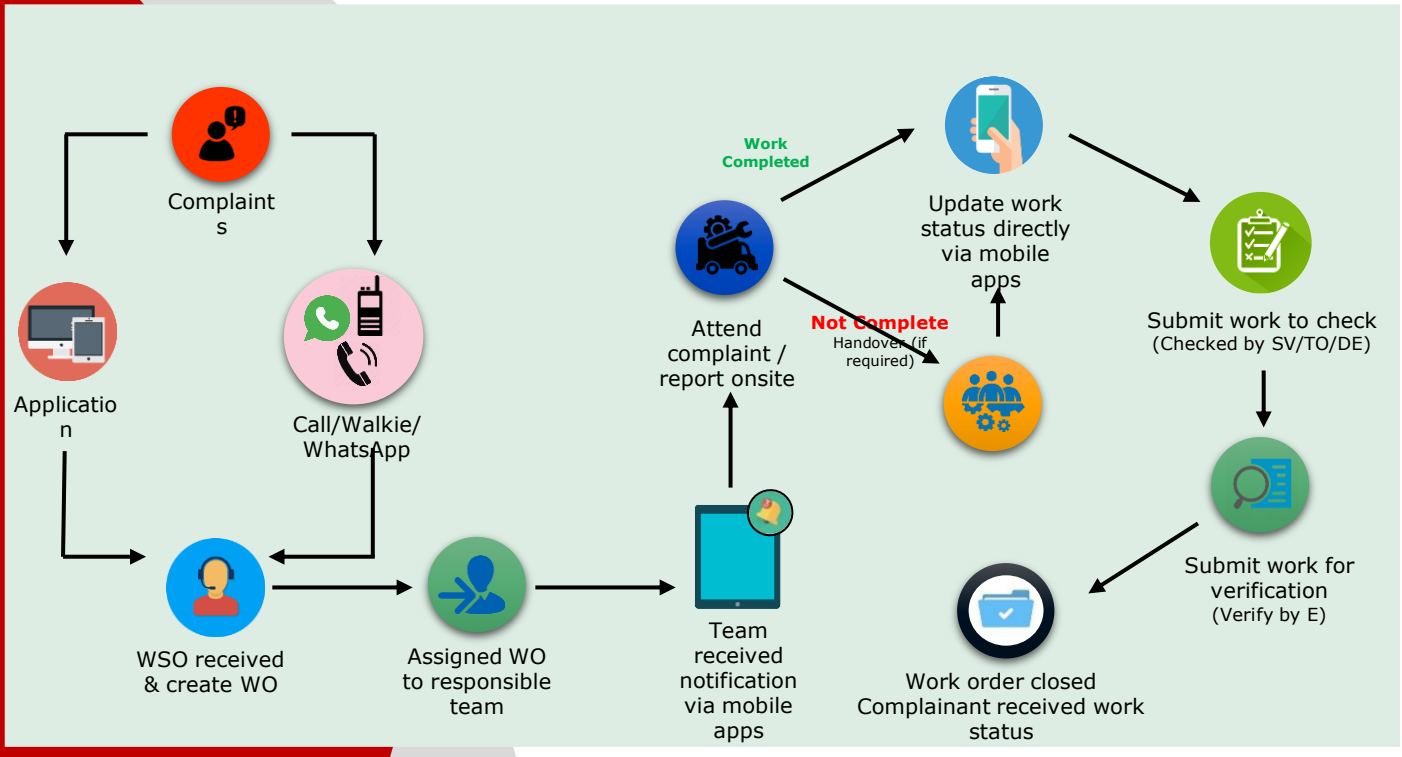
SMART ASSET®
Smart Asset Management Solutions

SMART ASSET - BENEFIT



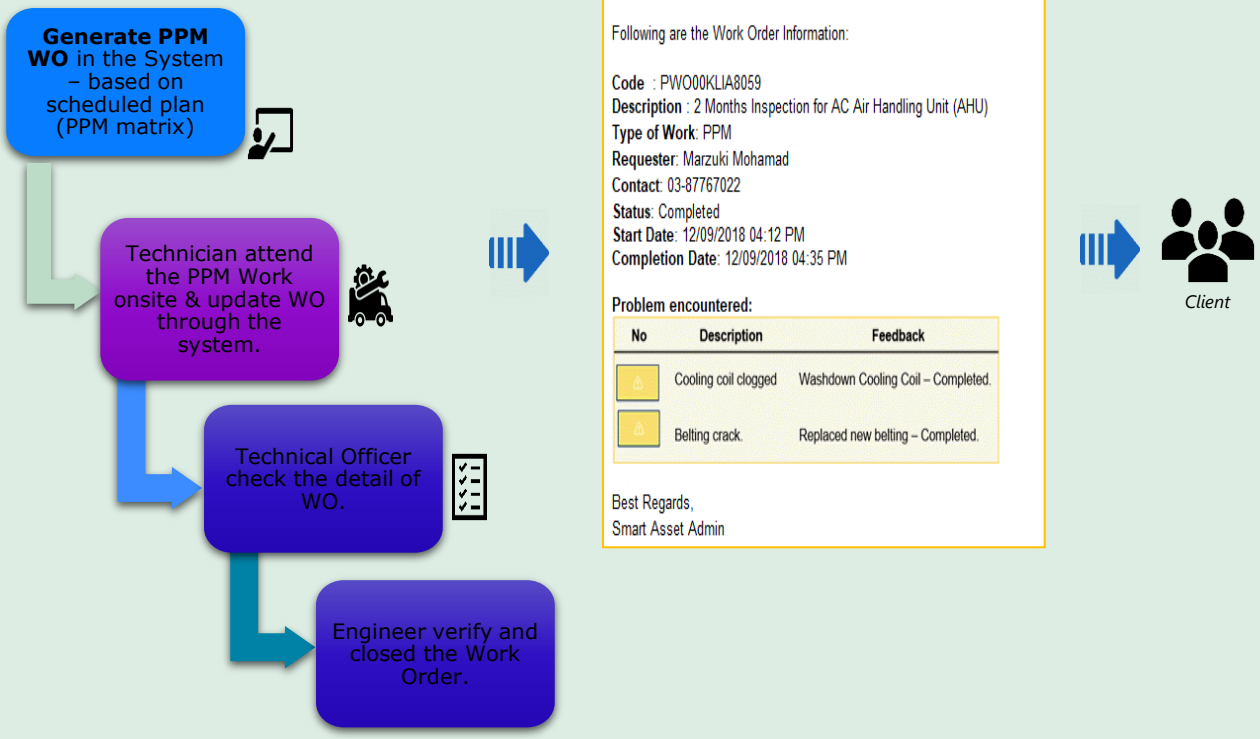
SMART ASSET - FUNCTION

SMART ASSET – WORK FLOW

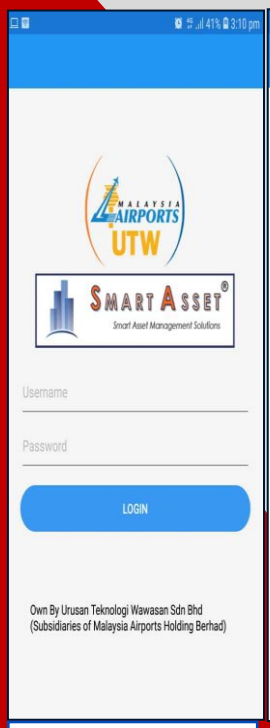


**TO=Technical Officer, WO=Work Order, PPM=Plan Preventive Maintenance, CM=Corrective Maintenance, E=Engineer, SV=Supervisor, DE=Duty Executive, WSO=Work Station Operator*

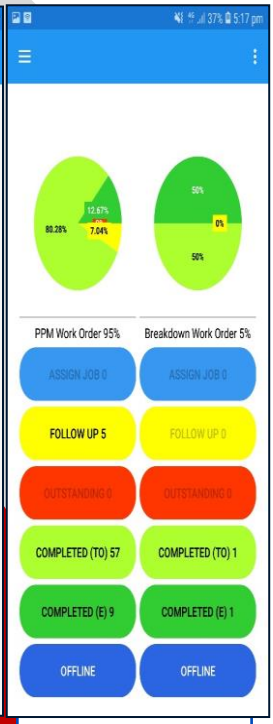
SMART ASSET – WORKFLOW (Preventive Maintenance)



SMART ASSET – MOBILE APPS

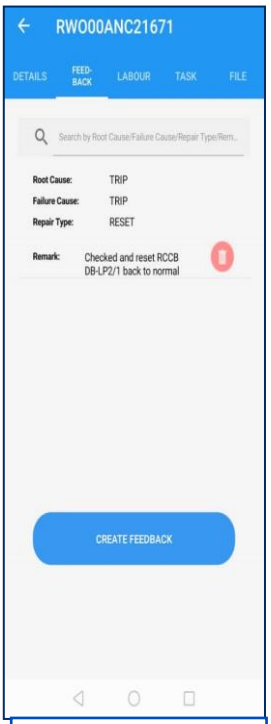


Login screen

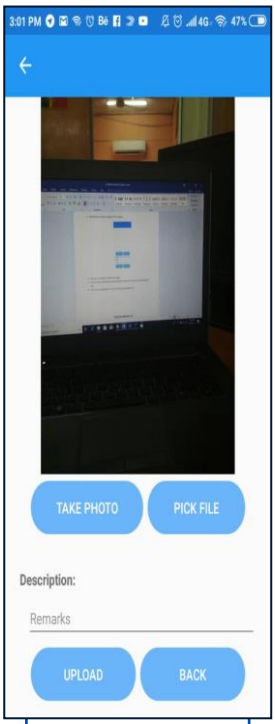


Dashboard

Real-Time Update work status

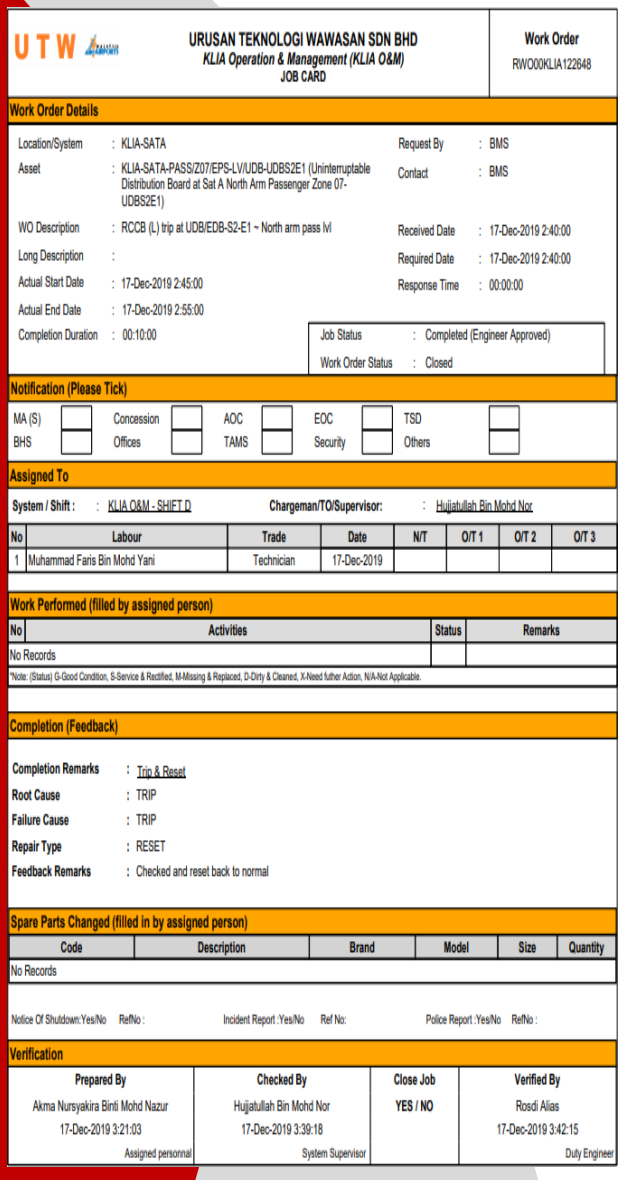


Real-Time Update work status



Snap breakdown image

SMART ASSET – REPORT EXAMPLE (JOB CARD)



URUSAN TEKNOLOGI WAWASAN SDN BHD
KLIA Operation & Management (KLIA O&M)
JOB CARD

Work Order
RWO00KLIA122648

Work Order Details

Location/System	: KLIA-SATA	Request By	: BMS
Asset	: KLIA-SATA-PASS/Z07/EPS-LV/UDB-UDBS2E1 (Uninterruptable Distribution Board at Sat A North Arm Passenger Zone 07-UDBS2E1)	Contact	: BMS
WO Description	: RCCB (L) trip at UDB/EDB-S2-E1 ~ North arm pass lvl	Received Date	: 17-Dec-2019 2:40:00
Long Description	:	Required Date	: 17-Dec-2019 2:40:00
Actual Start Date	: 17-Dec-2019 2:45:00	Response Time	: 00:00:00
Actual End Date	: 17-Dec-2019 2:55:00		
Completion Duration	: 00:10:00	Job Status	: Completed (Engineer Approved)
		Work Order Status	: Closed

Notification (Please Tick)

MA (S)		Concession		AOC		EOC		TSD	
BHS		Offices		TAMS		Security		Others	

Assigned To

System / Shift : KLIA O&M - SHIFT D Chargeman/TO/Supervisor: Hujjatullah Bin Mohd Nor

No	Labour	Trade	Date	N/T	O/T 1	O/T 2	O/T 3
1	Muhammad Faris Bin Mohd Yani	Technician	17-Dec-2019				

Work Performed (filled by assigned person)

No	Activities	Status	Remarks
No Records			

*Note: (Status) G-Good Condition, S-Service & Rectified, M-Missing & Replaced, D-Dirty & Cleaned, X-Need futher Action, N/A-Not Applicable.

Completion (Feedback)

Completion Remarks	: Trip & Reset
Root Cause	: TRIP
Failure Cause	: TRIP
Repair Type	: RESET
Feedback Remarks	: Checked and reset back to normal

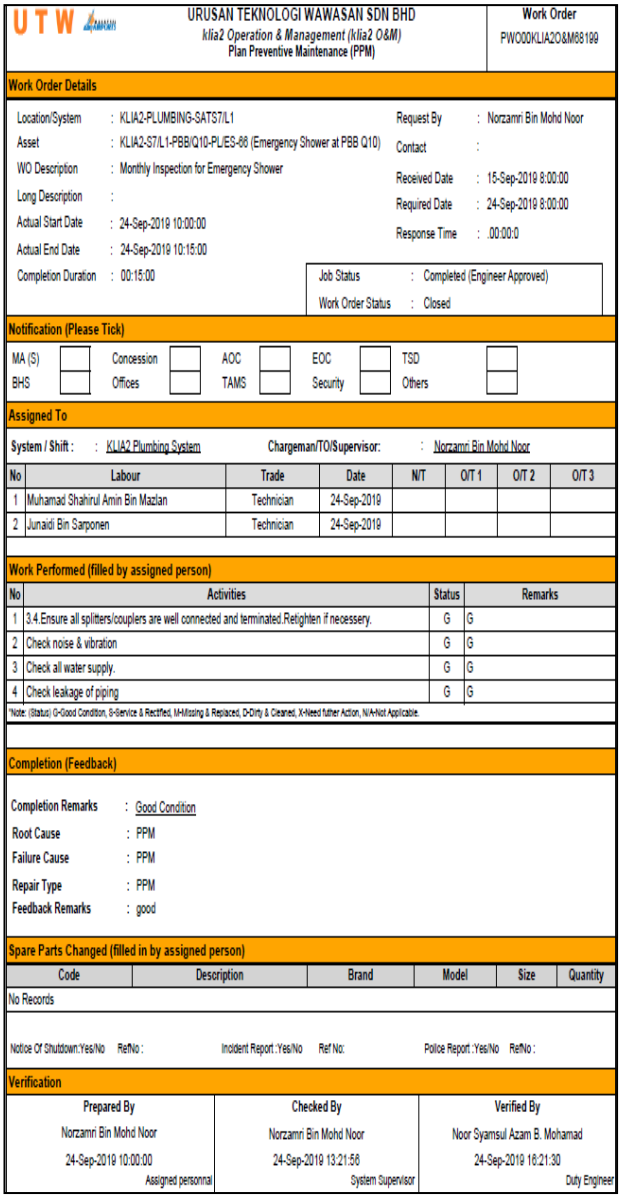
Spare Parts Changed (filled in by assigned person)

Code	Description	Brand	Model	Size	Quantity
No Records					

Notice Of Shutdown:Yes/No Ref/No : Incident Report :Yes/No Ref No: Police Report :Yes/No Ref/No :

Verification

Prepared By	Checked By	Close Job	Verified By
Akma Nursyakira Binti Mohd Nazur	Hujjatullah Bin Mohd Nor	YES / NO	Rosdi Alias
17-Dec-2019 3:21:03	17-Dec-2019 3:39:18		17-Dec-2019 3:42:15
Assigned personnal	System Supervisor		Duty Engineer



URUSAN TEKNOLOGI WAWASAN SDN BHD
klia2 Operation & Management (klia2 O&M)
Plan Preventive Maintenance (PPM)

Work Order
PWO00KLIA2O&M68199

Work Order Details

Location/System	: KLIA2-PLUMBING-SATS7/L1	Request By	: Norzamri Bin Mohd Noor
Asset	: KLIA2-S7/L1-PBB/Q10-PL/ES-66 (Emergency Shower at PBB Q10)	Contact	:
WO Description	: Monthly Inspection for Emergency Shower	Received Date	: 15-Sep-2019 8:00:00
Long Description	:	Required Date	: 24-Sep-2019 8:00:00
Actual Start Date	: 24-Sep-2019 10:00:00	Response Time	: .00:00:0
Actual End Date	: 24-Sep-2019 10:15:00		
Completion Duration	: 00:15:00	Job Status	: Completed (Engineer Approved)
		Work Order Status	: Closed

Notification (Please Tick)

MA (S)		Concession		AOC		EOC		TSD	
BHS		Offices		TAMS		Security		Others	

Assigned To

System / Shift : KLIA2 Plumbing System Chargeman/TO/Supervisor: Norzamri Bin Mohd Noor

No	Labour	Trade	Date	N/T	O/T 1	O/T 2	O/T 3
1	Muhamad Shahirul Amin Bin Mazlan	Technician	24-Sep-2019				
2	Junaidi Bin Sarponen	Technician	24-Sep-2019				

Work Performed (filled by assigned person)

No	Activities	Status	Remarks
1	3.4.Ensure all splitters/couplers are well connected and terminated.Retighten if necessery.	G	G
2	Check noise & vibration	G	G
3	Check all water supply.	G	G
4	Check leakage of piping	G	G

*Note: (Status) G-Good Condition, S-Service & Rectified, M-Missing & Replaced, D-Dirty & Cleaned, X-Need futher Action, N/A-Not Applicable.

Completion (Feedback)

Completion Remarks	: Good Condition
Root Cause	: PPM
Failure Cause	: PPM
Repair Type	: PPM
Feedback Remarks	: good

Spare Parts Changed (filled in by assigned person)

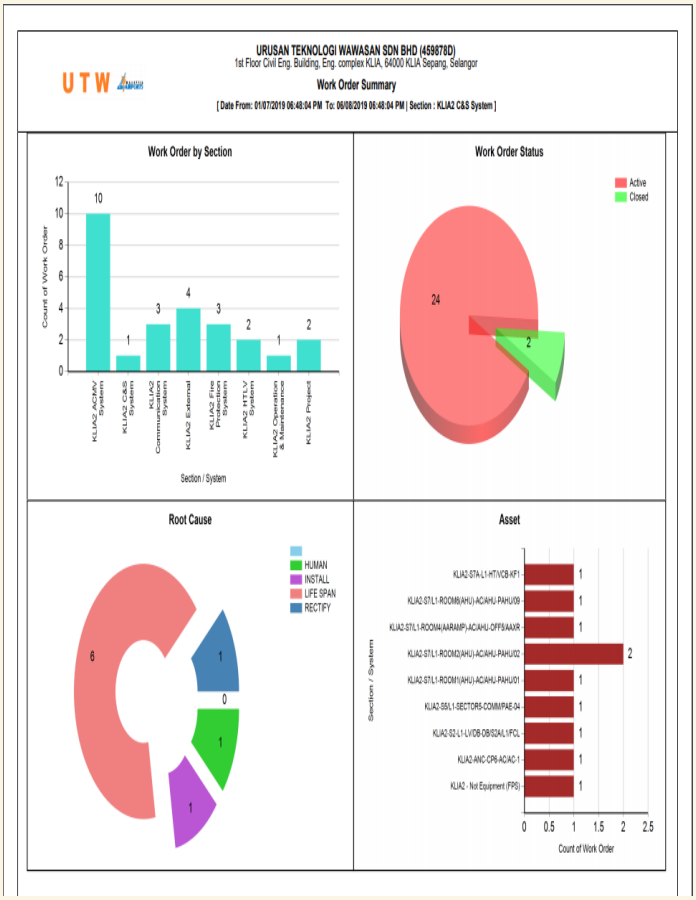
Code	Description	Brand	Model	Size	Quantity
No Records					

Notice Of Shutdown:Yes/No Ref/No : Incident Report :Yes/No Ref No: Police Report :Yes/No Ref/No :

Verification

Prepared By	Checked By	Verified By
Norzamri Bin Mohd Noor	Norzamri Bin Mohd Noor	Noor Syamsul Azam B. Mohamad
24-Sep-2019 10:00:00	24-Sep-2019 13:21:56	24-Sep-2019 16:21:30
Assigned personnal	System Supervisor	Duty Engineer

SMART ASSET – REPORT SUMMARY WORK BY SECTION/ SYSTEM



URUSAN TEKNOLOGI WAWASAN SDN BHD (459878D)
1st Floor Civil Eng. Building, Eng. complex KLIA, 64000 KLIA Sepang, Selangor

Work Order Summary

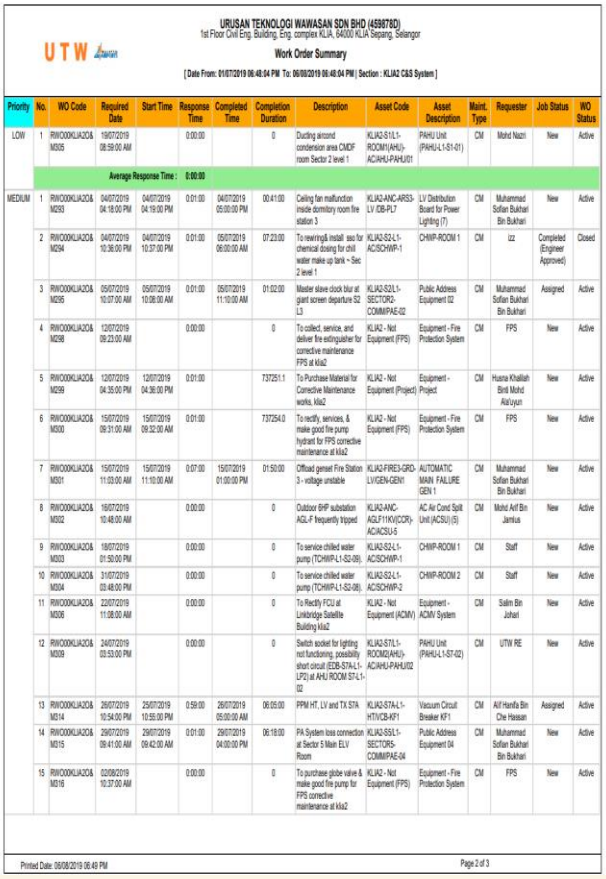
[Date From: 01/07/2019 06:48:04 PM To: 06/08/2019 06:48:04 PM | Section : KLIA2 C&S System]

Work Order by Section

Work Order Status

Root Cause

Asset



URUSAN TEKNOLOGI WAWASAN SDN BHD (459878D)
1st Floor Civil Eng. Building, Eng. complex KLIA, 64000 KLIA Sepang, Selangor

Work Order Summary

[Date From: 01/07/2019 06:48:04 PM To: 06/08/2019 06:48:04 PM | Section : KLIA2 C&S System]

Priority	No.	WO Code	Required Date	Start Time	Response Time	Completed Time	Completion Duration	Description	Asset Code	Asset Description	Maint. Type	Requester	Job Status	WO Status
LOW	1	RWO00KLIA2C&M035	19/07/2019 08:59:00 AM		0:00:00		0	Ducting aircond condension area CMDF room Sector 2 level 1	KLIA2-S1/L1-ROOM1(AHU)-AC/AHU-PAHU01	PAHU Unit (PAHU-L1-S1-01)	CM	Mohd Nazri	New	Active
		Average Response Time : 0:00:00												
MEDIUM	1	RWO00KLIA2C&M293	04/07/2019 04:18:00 PM	04/07/2019 04:19:00 PM	0:01:00	04/07/2019 05:00:00 PM	00:41:00	Ceiling fan malfunction inside dormitory room fire station 3	KLIA2-ANC-ARS3-LV DB-PL7	LV Distribution Board for Power Lighting (7)	CM	Muhammad Sofian Bukhari Bin Bukhari	New	Active
	2	RWO00KLIA2C&M294	04/07/2019 10:36:00 PM	04/07/2019 10:37:00 PM	0:01:00	05/07/2019 06:00:00 AM	07:23:00	To rewiring& install sso for chemical dosing for chill water make up tank + Sec 2 level 1	KLIA2-S2-L1-AC/SCHWP-1	CHWP-ROOM 1	CM	izz	Completed (Engineer Approved)	Closed
	3	RWO00KLIA2C&M295	05/07/2019 10:07:00 AM	05/07/2019 10:08:00 AM	0:01:00	05/07/2019 11:10:00 AM	01:02:00	Master slave clock blur at giant screen departure S2 L3	KLIA2-S2-L1-SECTOR2-COMM/PAE-02	Public Address Equipment 02	CM	Muhammad Sofian Bukhari Bin Bukhari	Assigned	Active
	4	RWO00KLIA2C&M298	12/07/2019 09:23:00 AM		0:00:00		0	To collect, service, and deliver fire extinguisher for corrective maintenance FPS at klia2	KLIA2 - Not Equipment (FPS)	Equipment - Fire Protection System	CM	FPS	New	Active
	5	RWO00KLIA2C&M299	12/07/2019 04:35:00 PM	12/07/2019 04:36:00 PM	0:01:00		737251.1	To Purchase Material for Corrective Maintenance works. klia2	KLIA2 - Not Equipment (Project)	Equipment - Project	CM	Husna Khalilah Binti Mohd Alaiyyun	New	Active
	6	RWO00KLIA2C&M300	15/07/2019 09:31:00 AM	15/07/2019 09:32:00 AM	0:01:00		737254.0	To rectify, services, & make good fire pump hydrant for FPS corrective maintenance at klia2	KLIA2 - Not Equipment (FPS)	Equipment - Fire Protection System	CM	FPS	New	Active
	7	RWO00KLIA2C&M301	15/07/2019 11:03:00 AM	15/07/2019 11:10:00 AM	0:07:00	15/07/2019 01:00:00 PM	01:50:00	Offload genset Fire Station 3 - voltage unstable	KLIA2-FIRE3-GRD-LV/GEN-GEN1	AUTOMATIC MAIN FAILURE GEN 1	CM	Muhammad Sofian Bukhari Bin Bukhari	New	Active
	8	RWO00KLIA2C&M302	16/07/2019 10:48:00 AM		0:00:00		0	Outdoor BHP substation AGL-F frequently tripped	KLIA2-ANC-AGLF11KV(CCR)-AC/ACSU-5	AC Air Cond Split Unit (ACSU) (5)	CM	Mohd Arif Bin Jamlus	New	Active
	9	RWO00KLIA2C&M303	18/07/2019 01:50:00 PM		0:00:00		0	To service chilled water pump (TCH/WP-L1-S2-09).	KLIA2-S2-L1-AC/SCHWP-1	CHWP-ROOM 1	CM	Staff	New	Active
	10	RWO00KLIA2C&M304	31/07/2019 03:48:00 PM		0:00:00		0	To service chilled water pump (TCH/WP-L1-S2-08).	KLIA2-S2-L1-AC/SCHWP-2	CHWP-ROOM 2	CM	Staff	New	Active
	11	RWO00KLIA2C&M306	22/07/2019 11:08:00 AM		0:00:00		0	To Rectify FCU at Linkbridge Satellite Building klia2	KLIA2 - Not Equipment (ACMV)	Equipment - ACMV System	CM	Salim Bin Johari	New	Active
	12	RWO00KLIA2C&M309	24/07/2019 03:53:00 PM		0:00:00		0	Switch socket for lighting not functioning, possibility short circuit (EDB-S7A-L1-LP2) at AHU ROOM S7-L1-02	KLIA2-S7/L1-ROOM2(AHU)-AC/AHU-PAHU02	PAHU Unit (PAHU-L1-S7-02)	CM	UTW RE	New	Active
	13	RWO00KLIA2C&M314	29/07/2019 10:54:00 PM	25/07/2019 10:55:00 PM	0:59:00	26/07/2019 05:00:00 AM	06:05:00	PPM HT, LV and TX S7A	KLIA2-S7A-L1-HT/VCB-KF1	Vacuum Circuit Breaker KF1	CM	Alif Hanifa Bin Che Hassan	Assigned	Active
	14	RWO00KLIA2C&M315	29/07/2019 09:41:00 AM	29/07/2019 09:42:00 AM	0:01:00	29/07/2019 04:00:00 PM	06:18:00	PA System loss connection at Sector 5 Main ELV Room	KLIA2-S5/L1-SECTOR5-COMM/PAE-04	Public Address Equipment 04	CM	Muhammad Sofian Bukhari Bin Bukhari	New	Active
	15	RWO00KLIA2C&M316	02/08/2019 10:37:00 AM		0:00:00		0	To purchase globe valve & make good fire pump for FPS corrective maintenance at klia2	KLIA2 - Not Equipment (FPS)	Equipment - Fire Protection System	CM	FPS	New	Active

Printed Date: 06/08/2019 06:49 PM

Page 2 of 3

SMART ASSET – REPORT PPM WEEKLY

Rev.: 001

URUSAN TEKNOLOGI WAWASAN SDN BHD (459878D)

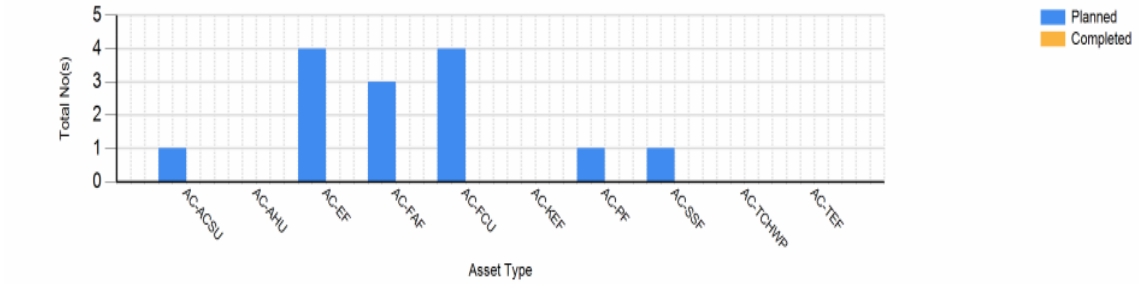
1st Floor Civil Eng. Building, Eng. complex KLIA, 64000 KLIA Sepang, Selangor

PPM Weekly

[Section: [SEC00KLIA203] KLIA2 ACMV System | Year: 2019 | Week: 18]

Week 18 : 06 May 2019 to 12 May 2019 (Monday to Sunday)		
	06 May to 12 May	13 May to 19 May
PPM Measurement Chart (M&E)	Week 18	Week 19
Total PPM's Planned	18	0
Total PPM's Completed	0	0
Total PPM's Outstanding	18	0

Asset Type	Week 18 (Planned)	Week 18 (Completed)	% Completed On Time	Resheduled	Week 19	Percentage (%)
AC-ACSU	1	0	0	1	0	0
AC-AHU	0	0	0	0	1	100
AC-EF	4	0	0	4	0	0
AC-FAF	3	0	0	3	0	0
AC-FCU	4	0	0	4	0	0
AC-KEF	0	0	0	0	1	100
AC-PF	1	0	0	1	0	0
AC-SSF	1	0	0	1	0	0
AC-TCHWP	0	0	0	0	1	100
AC-TEF	0	0	0	0	1	100



	AC-ACSU	AC-AHU	AC-EF	AC-FAF	AC-FCU	AC-KEF	AC-PF	AC-SSF	AC-TCHWP	AC-TEF
Week 18 (Planned)	1	0	4	3	4	0	1	1	0	0
Week 18 (Completed)	0	0	0	0	0	0	0	0	0	0
% Completed On Time	0	0	0	0	0	0	0	0	0	0

SMART ASSET – REPORT PPM MATRIX

URUSAN TEKNOLOGI WAWASAN SDN BHD (459878D)

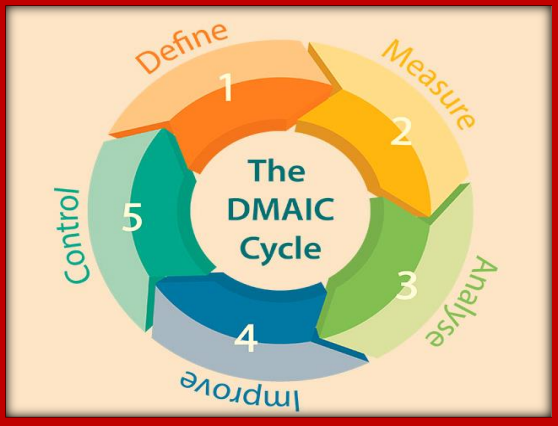
1st Floor Civil Eng. Building, Eng. complex KLIA, 64000 KLIA Sepang, Selangor

PPM Matrix

[Date From: 01/05/2019 To: 31/05/2019 | Asset Type: AC-FCU]

Asset Code	Asset Description	Schedule Code	Schedule Description	Frequency	PPM Schedule																												
					Week 18				Week 19							Week 20							Week 21							Week 22				
					01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Air Conditioning Mech. Ventilation System (ACMV)- MTB S1/L1A																																	
KLIA2-S1/L1A-HH/04-AC/FCU-4	FCU Panel (FCU-L1A-S1-HH 04)	KLIA2-PPM-Q-AC/FCU	Quarterly Inspection for AC Fan Coil Unit	3 Monthly	✓																												
KLIA2-S1/L1A-HH/05-AC/FCU-5	FCU Panel (FCU-L1A-S1-HH 05)	KLIA2-PPM-Y-AC/FCU	Yearly inspection for Fan Coil unit at KLIA2	1 Yearly	✓																												
KLIA2-S1/L1A-HH/06-AC/FCU-6	FCU Panel (FCU-L1A-S1-HH 06)	KLIA2-PPM-Q-AC/FCU	Quarterly Inspection for AC Fan Coil Unit	3 Monthly	✓																												
KLIA2-S1/L1A-HH/07-AC/FCU-7	FCU Panel (FCU-L1A-S1-HH 07)	KLIA2-PPM-Q-AC/FCU	Quarterly Inspection for AC Fan Coil Unit	3 Monthly	✓																												
KLIA2-S1/L1A-HH/08-AC/FCU-8	FCU Panel (FCU-L1A-S1-HH 08)	KLIA2-PPM-Q-AC/FCU	Quarterly Inspection for AC Fan Coil Unit	3 Monthly	✓																												
KLIA2-S1/L1A-HH/09-AC/FCU-9	FCU Panel (FCU-L1A-S1-HH 09)	KLIA2-PPM-Q-AC/FCU	Quarterly Inspection for AC Fan Coil Unit	3 Monthly	✓																												
KLIA2-S1/L1A-HH/10-AC/FCU-10	FCU Panel (FCU-L1A-S1-HH 10)	KLIA2-PPM-Y-AC/FCU	Yearly inspection for Fan Coil unit at KLIA2	1 Yearly	✓																												
KLIA2-S1/L1A-HH/11-AC/FCU-11	FCU Panel (FCU-L1A-S1-HH 11)	KLIA2-PPM-Q-AC/FCU	Quarterly Inspection for AC Fan Coil Unit	3 Monthly	✓																												
KLIA2-S1/L1A-HH/12-AC/FCU-12	FCU Panel (FCU-L1A-S1-HH 12)	KLIA2-PPM-Q-AC/FCU	Quarterly Inspection for AC Fan Coil Unit	3 Monthly	✓																												
KLIA2-S1/L1A-HH/13-AC/FCU-13	FCU Panel (FCU-L1A-S1-HH 13)	KLIA2-PPM-Q-AC/FCU	Quarterly Inspection for AC Fan Coil Unit	3 Monthly	✓																												
KLIA2-S1/L1A-HH/14-AC/FCU-14	FCU Panel (FCU-L1A-S1-HH 14)	KLIA2-PPM-Y-AC/FCU	Yearly inspection for Fan Coil unit at KLIA2	1 Yearly	✓																												
KLIA2-S1/L1A-HH/15-AC/FCU-15	FCU Panel (FCU-L1A-S1-HH 15)	KLIA2-PPM-Q-AC/FCU	Quarterly Inspection for AC Fan Coil Unit	3 Monthly	✓																												
KLIA2-S1/L1A-HH/16-AC/FCU-16	FCU Panel (FCU-L1A-S1-HH 16)	KLIA2-PPM-Q-AC/FCU	Quarterly Inspection for AC Fan Coil Unit	3 Monthly	✓																												
KLIA2-S1/L1A-HH/17-AC/FCU-17	FCU Panel (FCU-L1A-S1-HH 17)	KLIA2-PPM-Q-AC/FCU	Quarterly Inspection for AC Fan Coil Unit	3 Monthly	✓																												

So What We Do We All The Data?



KAIZEN SUGGESTION SHEET

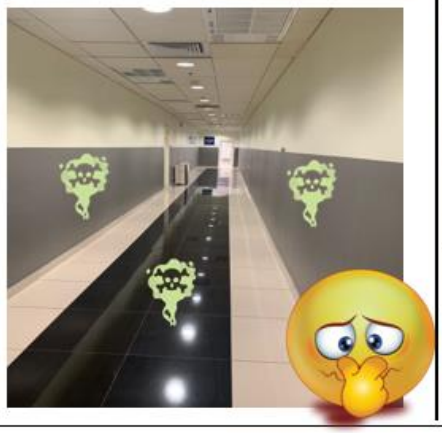
(BORANG CADANGAN KAIZEN)

Suggestion Date: 29/3/2021	Log Number: M&E/MTB/01

KAI CHANGE + ZEN BETTER = KAIZEN CONTINUOUS IMPROVEMENT

Originator/Pencadang: Amirul Rasyid Bin Yussof	Div/Unit Head/Shift Leader: Mohd Ibrahim Jaal	Div/Unit/Shift: ENG-BS KLIA
Suggestion/Cadangan (to be filled by Originator): **To reduce smoke odour inside Centre of Excellence (CoE) corridor.** - **Upgrading existing exhaust fan and extending ducting into Centre of Excellence (CoE) corri** - **Spray Nano Coating** - **Install Air Cleaner**	**Action Taken** - **Upgrading exhaust fan and extending nearby ducting to add 500 Cubic Feet per Minute (CFM) suction.** - **Spray Nano Coating on wall** - **Install 4 Air Cleaner with built in Ultraviolet Ray**	**Results/Expected Results/Hasil Tindakan** (to be filled by Div/Unit Head/Shift Leader): - **Suction increased 500CFM compared to existing** - **No smoke can penetrate the nano layer coating** - **1200 CFM air treatment each, 4800 CFM total air treatment, up to 95% filtration efficiency at 0.3 micron**

Situation Before Actions / Situasi Sebelum Tindakan:



Situation After Actions /Situasi Selepas Tindakan:

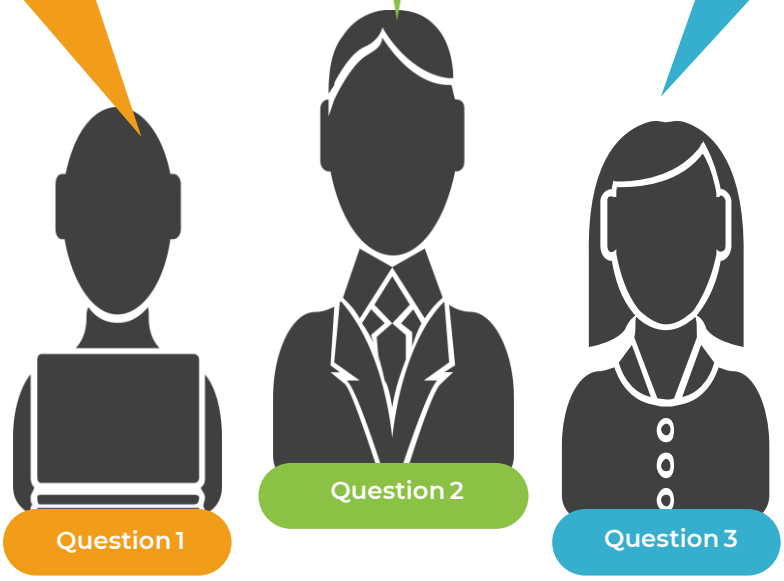
Reviewed Date: 12/3/2021	Reviewed By: Amirul-Khairul-Ibrahim
Status: Implement / ~~Keep In View~~ ✓	
Implementation Due Date: 26/4/2021	

Do your exercise

One of the evaluation factors in measuring the efficiency of building maintenance management systems is by keeping a record. **List the benefits of keeping records for every operation of maintenance work.**

Describe work request **priority levels** in building maintenance.

List 6 advantages of keeping an equipment maintenance record



Case Study Question

INTRODUCTION:

Building defect occurs to either the new building or the old ones. Defect within new buildings is maybe of non-compliance with Building Code and published acceptable tolerances and standards. Meanwhile the older buildings, or building out of warranty period, may not comply with these standards but must be judged against the standard at the time of construction or refurbishment. (David Hall)

INSTRUCTION:

You are required to work in groups of 4 or 5.

i. Locate a building / area of inspection within area of Politeknik Sultan Salahuddin Abdul Aziz Shah, Selangor.
ii. Discuss a type of maintenance management (planned maintenance, unplanned maintenance, or corrective maintenance).
iii. Identify a Building Inspection Checklist that suites the building / area and the type of maintenance management
iv. Produce a Building Inspections based on the checklist above
v. Proposed a maintenance's planning work based on the checklist above
vi. Produce a Maintenance Work Report based on the Building's Inspections activities. The contents of the Maintenance Work Report should include Overview, Summary of Findings, Introductions, Maintenance and Repair (M&R) Estimating Cost, Replacement Cost and Conclusions.
vii. All the findings of the Building's Inspections MUST be supported by images related to the it.

CHAPTER 3
REFERENCES

Abdul Lateef Olanrewaju, Arazi Idrus and Mohd Faris Khamidi Investigating building maintenance practices in Malaysia: a case study Department of Civil Engineering, Universiti Teknologi Petronas, Tronoh, Malaysia

Assertive Option Services, En. Mat Rodzi Bin Abdul Raof , Kursus Penyelenggaraan Bangunan, CIDB.

Anthony, L. T.,(2013). *New buildings could also have structural defects*. [Online] Available at: http://www.themalaymailonline.com/malaysia/article/new- buildings-could-also-have-structural-defects

Frank Gatlin, A. N., 2013. Navigant. Identifying & Managing Design and Construction Defects.

https://ftmaintenance.com/maintenance-management/what-is-maintenance-management/

http://www.drfixitinstitute.com/download/rebuild_2010/Rebuild%20vol%204%20no%202%20AprJun%202010/Rebuild%20vol%204%20no%202%20Apr-Jun%202nd.pdf

Kamaruzzaman, S.N., Zawawi, E.A. and Omar, A. (2011). "Preliminary evaluation of problems involved in maintaining heritage buildings in Malaysia." The Professional Journal of the Institution of Surveyors, 46(1); pp. 30-38

Kayan, B.A. (2020). Green Maintenance of Heritage Buildings A Sustainable Repair Approach. Universiti of Malaya Press Kuala Lumpur.

Malaysia Airport Holdings Berhad.

Minter, E. (2016). Defects Liability period. [Online] Available at:

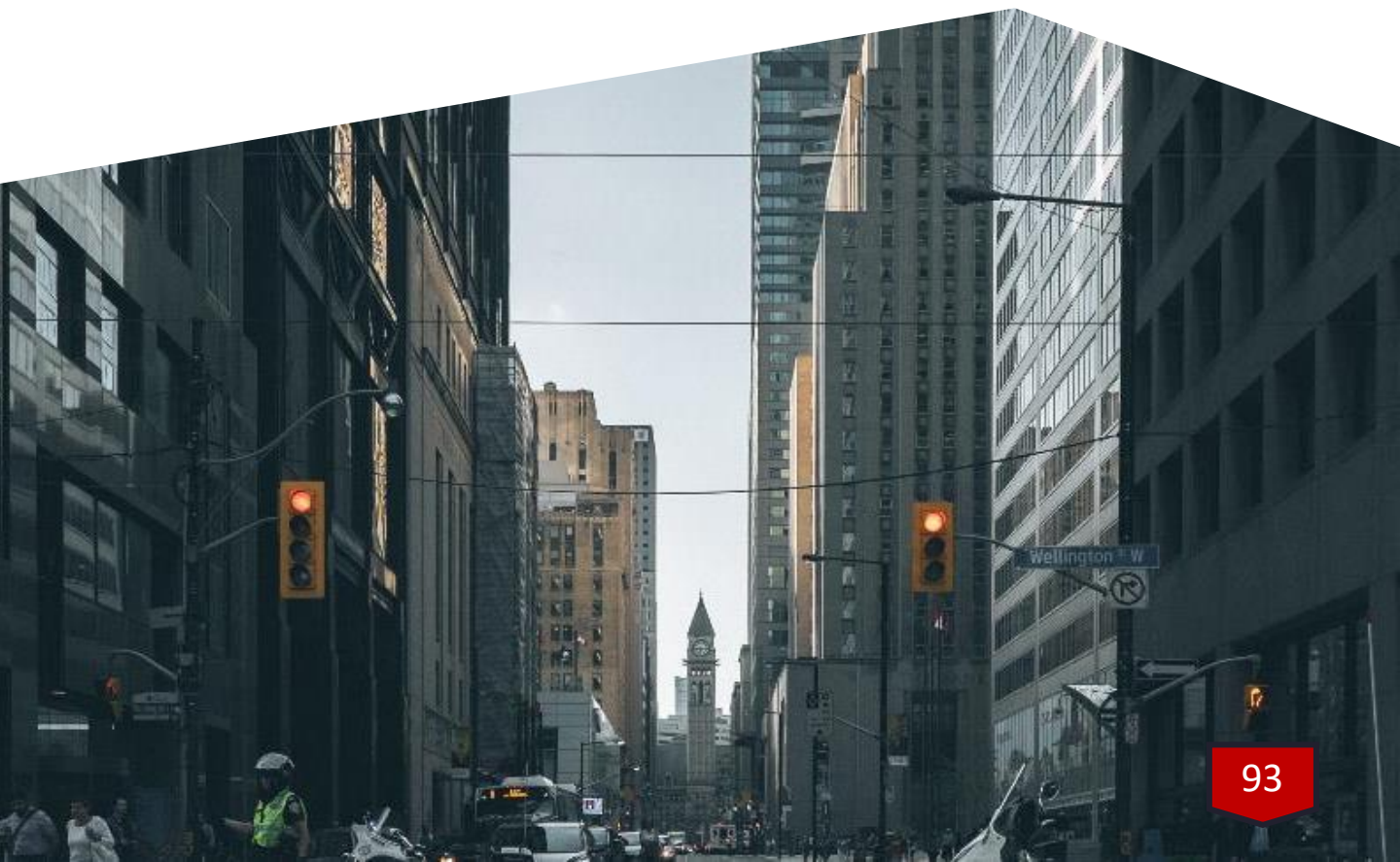
http://www.constructionlawmadeeasy.com/Defectsliabilityperiod

Conclusion

The author hopes that this eBook can help students perform building investigation procedures easily and in an organized manner.

In Building Maintenance Management, documentation and reporting systems are very important. Building maintainers need to know and efficiently handle the relevant documentation forms.

With this eBook, users can refer to and make improvements from time to time about the maintenance in the building.



Terbitan:

POLITEKNIK MALAYSIA
SULTAN SALAHUDDIN ABDUL AZIZ SHAH

e ISBN 978-967-2044-64-2

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