



DEPARTMENT OF OCCUPATIONAL  
SAFETY AND HEALTH  
MINISTRY OF HUMAN RESOURCES



**BEST PRACTICES  
ON OCCUPATIONAL  
SAFETY AND HEALTH  
IN CONSTRUCTION INDUSTRY 2019**



# ACKNOWLEDGMENTS

The Best Practice on Occupational Safety and Health in Construction Industry 2019 (1<sup>st</sup> Revision) have been prepared by the Safety and Health Officer (SHO) from Giant Leap Construction Sdn. Bhd. with collaboration from Department of Occupational Safety and Health, Johor of the following:

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# FOREWORD



I would like to take this opportunity to thank the Department of Occupational Safety and Health (DOSH) Johor and Giant Leap Construction Sdn. Bhd. for being committed in preparation of these best practice. The Best Practice on Occupational Safety and Health in Construction Industry 2019 (1st Revision) from Giant Leap Construction Sdn. Bhd. with collaboration from DOSH Johor is developed to recommend the minimum roles of every construction sites and how they can execute their responsibilities to trigger improvements in the safety and health performance.

The purpose of these best practice is to provide guidance on how good work practices can be carried out on every activity in the construction to prevent accident to the workers and public. We hope that this guideline will serve as a standard reference and will be able to significantly boost occupational safety and health to protect the employers, workers at sites and public.

We are proud that there is international company volunteer to take initially action to accomplish this best practice. In line with that, we would encourage all parties concerned to make the work site and its surrounding area a safer place for the workers as well as the public by following the recommended practices. May all measures taken be beneficial and have a comprehensive impact for all parties, in particular employers and workers, who aspire to a safe, healthy and harmonious work environment. Let us all work together to ensure that this best practice achieves its set vision and mission.

Thank you.

Director-General,

Department of Occupational Safety and Health, Malaysia

# FOREWORD



The Best Practice on Occupational Safety and Health in Construction Industry 2019 are prepared for the Construction Safety and Health production and facilities on site and the CI image arrangement required by Giant Leap Construction Sdn. Bhd. This best practice are applicable for residences, public buildings, municipal construction, bridges and all construction types, especially for high-rise building.

The best practice comprise of 26 chapters that cover the range from the sub-structure to finishing works including piling works, pile cap foundation, main building structural works, interior decoration, steel structure construction and installation etc.; all aspects of building construction activities and temporary protective provisional system enhancing safety to provide safe and healthy workplace environment. Each preventive measure mentioned in the best practice conspicuously quote the statutory references relates Malaysian OSH Acts and Standards. The demonstration are carefully tailored with sequential construction activities for straightforward references. The illustration pictures adopted in this guideline are actual pictures taken from our project sites and the sketch drawings are from Giant Leap manual which contains vital information that has been stated clearly and simply understandable to implement at any project sites. All the preventive measures that stated in the best practice are implemented in our project sites within the provisional safety budget. Undoubtedly the best practice will serve good and effective reference point to achieve the goal to provide safe and healthy construction work environment.

The idea to formulate the best practice was initiated by Mr. Ir. Hj. Saiful Azhar Bin Said (JKKP) upon his visit to one of our construction sites in Forest City project, Johor in 2017; his attention was drawn to observe the standardized safety protective system applied similarly with other adjacent sites and he was astonished the familiarity and uniformity, which prompts him to propose Giant Leap Construction Sdn. Bhd. to produce a written manual which could contribute to construction industries in Malaysia as reference guidance.

With the participation of DOSH officers, Giant Leap's dedicated safety personnel organized the construction safety best practice compositing to meet the requirement of building construction safety in Malaysia. The team had added significant chapters to narrow the disparity and significantly distinctive to meet Malaysian Safety Standard and made it viable for comprehensive reference book conclusively for construction activity with sequent arrangement of chapters from sub-structure to finishing works; some minor adjustments was made so that it is identical to local law and regulation compliances especially OSH Act 514, Factory and Machinery Act 139 and it's regulations and code of practices.

The best practice has another extra advantage with bilingual language on English and Chinese versions together and would benefit both local and foreign industry players operating their construction activities in Malaysia. The main objective of this guideline is to strive and stipulate hazard preventive measures to safeguard the wellbeing of workers and to cultivate and foster safe work practices in construction industry to prevent injury to workers.

I on behalf of Giant Leap Construction Sdn Bhd want to pay our highest gratitude to JKPP for their tireless support and guidance in achieving the accomplishment of making the best practice. Hopefully the guidance would serve at its best to maintain construction site safety and healthy environment during the construction work and would contribute to reduce industrial accidents at project work sites.

Thank you

Regards,

General Manager,

Giant Leap Construction Sdn Bhd



Giant Leap Construction Sdn Bhd (1076133-P) was formed on 2<sup>nd</sup> January 2014, with registered capital RM5,000,000. We are the leading main contractor holding G7 license specialize on construction services for railway, commercial, residential, leisure, infrastructures and other relevant projects.

Country Garden is a Fortune 500 corporate with ranking 177 in 2019 and proudly become the largest property developer in China. As its subsidiary company, Giant Leap Construction Sdn Bhd have always been following their footsteps in expanding overseas markets. Till now we have expanded our business to Indonesia, East Malaysia and soon to Thailand, Philippines, Vietnam and others. Malaysia will be the center and leading the direction of our company in South East Asia market.

Since we entered Malaysia in 2014, our company have completed over 15 large scale high-rise projects, and now have 7 on-going projects. With high experience and advanced cutting-edge techniques as well as excellent project management in quality, process and safety control, we have garnered tremendous success and award in the industry, such as Forest city Plot 4 successfully achieved 3million man hours without loss time injury

Our advantages are:

- (1) Well established company background and financing advantages: has the capabilities to handle approximately 2million m<sup>2</sup>. With a robust and strong company background, our company has sufficient reserve fund that can fully support our operations.
- (2) Professional Team: We have professional team that provides strategic planning, resources, systematic project management and solution.
- (3) Sufficient local resources: Nearly 200 subcontractors and 100 material suppliers, more than 300 employees with more than 60% local management talents and 300 legal foreign labours, allow us to provide more room in competitive pricing and speedy construction.

- (4) Innovative technology: We implement the systematic and high efficiency BIM system into our project management our prefabricated construction research and development includes PC elements planning to construction site which can improve the productivity.
- (5) Research Centre: Our Building industrialization Research Centre has set up a professional BIM team to advance our current construction technology.

We are not only the pioneer but also a driving force for the technology revolution in the construction industry, such as prefabricated building, BIM technology and smart site, which will be the future of construction industry.

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# **CHAPTER 1**

## **LEGAL REQUIREMENT**

# Chapter 1 Legal Requirements

## 1.1 Introduction

The general safety, wellbeing of workers must be safeguard against the hazards associated with construction work that may carried out in a safe manner relatively safe method of work being adopted at building construction workplace. This best practice applies to all place of work in building operation and work of engineering construction activity in Malaysia covered by the Occupational Safety and Health Act 1994 (Act 514), the Factories and Machinery Act 1967 (Act 139), and all its regulations made under the Acts. It is designed to serve as a handy reference and to be read together with the above mentioned legislations and other industry codes of practice.

## 1.2 Objective

The purpose of these best practice is to provide guidance to Construction Management team on good work practices that can be carried out on every activity in the workplace to prevent accident to the workers.

## 1.3 Definition

- a) **Employer** - means immediate employer or the principal employer or both.(Section 3, Occupational Safety and Health Act 1994)
- b) **Developer** - any person, body of persons, company, firm or society who or which engages in or carries on or undertakes the business of developing or providing monies for development or purchasing buildings or partly developing and providing monies for purchasing buildings. (Section 3, Street, Drainage, And Building Act - Act 133)
- c) **Contractor** - a person who has entered into a contract for the purpose of carrying out any building operations or work of engineering construction and includes a main contractor or subcontractor. (Regulation 2, Building Operations And Works Of Engineering Construction – Regulations 1986).
- d) **Main contractor** - a person who has entered into a contract with an owner or lessee of a property or his agent for the purpose of carrying out any building operations or work of engineering construction. (Regulation 2, Building Operations And Works Of Engineering Construction – Regulations 1986)
- e) **Safety and Health Officer** - a person who registered under provision of regulation 6(1), Occupational Safety and Health (Safety and Health Officer) Regulations 1997.

- f) **Designated Person** - a competent person appointed by an employer to carry out any supervision or inspection or to perform any tasks or duty prescribed by Building Operations and Works of Engineering Construction (Safety) Regulations, 1986.
- g) **Contractor Safety Supervisor** - a contractor's safety supervisor appointed under regulation 26, Building Operations and Works of Engineering Construction (Safety) Regulations, 1986.
- h) **Site Safety Supervisor** - a site safety supervisor appointed under regulations 25, Building Operations and Works of Engineering Construction (Safety) Regulations, 1986.
- i) **Professional Engineer** means a "registered Professional Engineer" as defined by section 2 of the Registration of Engineers Act 2002 (Amendment).

#### **1.4 Legal requirement**

Subjected to section 17(1) under Occupational Safety And Health Act 1994, it shall be the duty of employer and every self-employed person to conduct his undertaking in such a manner as to ensure, so far as is practicable, that he and the other persons, not being his employees, who may be affected thereby are not thereby exposed to risks to their safety or health.

Subjected to section 17(2) under Occupational Safety And Health 1994, it shall be the duty of employer and every self-employed person, in the prescribed circumstances and in the prescribed manner, to give to persons, not being his employees, who may be affected by the manner in which he conducts his undertaking, the prescribed information on such aspects of the manner in which he conducts his undertaking as might affect their safety or health.

Remarks, refer to **Factories and Machinery Act and Regulations, Act 139**

#### **1.5 Notification of an operation**

- a) Subjected to Section 35 under Factories and Machinery Act 1967, every person who undertakes any building operations or works of engineering construction shall notify to Department of Occupational Safety and Health not later than seven days from the commencement of construction activities.
- b) The notification is exempted to the construction activities that can be completed in a period less than six (6) weeks and does not involve the use of machinery.

#### **1.6 Notification and reporting of an accident and dangerous occurrence**

- a) Section 32 under Occupational Safety and Health Act 1994, an employer shall notify the nearest Department of Occupational Safety and Health office of any accident, dangerous occurrence, occupational poisoning or occupational disease which has occurred or is likely to occur at the place of work.

- b) Method of notification and reporting an accident shall comply with Occupational Safety and Health (Notification of Accident, Dangerous Occurrence, Occupational Poisoning and Occupational Disease) Regulation 2004.

## **1.7 Safety and Health Organizations**

### **1.7.1 Safety and Health Policy**

- a) Every employer shall prepare and as often as may be appropriate revise a written statement of his general policy with respect to the safety and health at work of his employees and the organization and arrangements for carrying out that policy, and to bring the statement and any revision of it to the notice of all of his employees. (Section 16, Occupational Safety and Health Act 1994)

### **1.7.2 Safety and Health Committee**

- a) The main contractor of a worksite in which forty or more persons are for the time being employed (whether by him or by other contractors employed by him or the client) shall establish a safety and health committee (on which both employees and management are represented) for the purpose of keeping under review conditions in the worksite which may affect the safety and health of the persons employed therein or the public. (Section 30, Occupational Safety and Health Act 1994, Occupational Safety and Health (Safety and Health Committee – Regulation 1997)

### **1.7.3 Occupational Safety and Health Management System**

- a) Every employer should established, implement and maintain an occupational safety and health management system and shall be in accordance with the requirement of the relevant Malaysian Standard or with any other equivalent Occupational Safety and Health Management System approved by Director General.

### **1.7.4 Safety and Health Officer**

- a) Every employer of any building operation and work of engineering construction when the total contract price of the project exceeds twenty million ringgit Malaysia, they shall employ a safety and health officer. (Section 29, Occupational Safety and Health Act 1994, Occupational Safety and Health (Safety and Health Officer) order 1997)

### **1.7.5 Site Safety Supervisor**

- a) The main contractor of a worksite shall appoint a part time site safety supervisor who should spend at least fifteen hours per week exclusively on safety supervision and on promoting the safe conduct of work generally within the site. (Reg. 25, Building Operation and Works Of Engineering Construction (Safety) Regulations, 1986)

### **1.7.6 Contractor Safety Supervisor**

- a) Every contractor other the main contractor in charge of worksite who employs more than twenty persons to carry out work on a worksite shall appoint a part time contractor's safety supervisor, who should spend at least five hours per week exclusively on safety supervision and on promoting the safe conduct of work generally by his employees. (Reg. 26, Building Operations And Works Of Engineering Construction (Safety) Regulations, 1986)

### **1.8 General Duties of Employers**

- a) Every developer, main contractor, contractor and sub-contractor shall have a written statement of his general policy with respect to the safety and health at work of his employees and other persons who are not his employees, who may be exposed to risks to their safety and health. (Section 16, Occupational Safety and Health Act 1994)
- b) Every main contractor, contractor and sub-contractor shall develop a safety and health manual that has provision for safe guarding the safety and health of the public and his employees. (Section 15(2)(a), Occupational Safety and Health Act 1994)
- c) Every main contractor, contractor and sub-contractor shall make an arrangement during operation, handling, transport, storage of plant and substance, to ensure the safety and health to the employees and public. (Section 15(2)(b), Occupational Safety and Health Act 1994)
- d) Every developer, main contractor, contractor and sub-contractor shall ensure that all workers are properly informed of the hazards of their respective occupations and the precautions necessary and adequately supervise to avoid accidents, injuries and risk to health, and in particular that young workers, newly engaged workers, illiterate and foreign workers. (Section 15(2)(c), Occupational Safety and Health Act 1994)
- e) Every developer, main contractor, contractor and sub-contractor shall provide sufficient allocation for ensuring that provisions to ensure the public and his employee's safety and health are implemented and maintained.

- f) Every owner, developer, main contractor, contractor and sub-contractor shall take adequate steps to develop and promote safety and health programs to ensure not only the safety and health of his employees but also members of the public.

### **1.9 General Duties of Architects, Engineers and Designers**

- a) At the planning stage of any proposed building or civil engineering works, specific consideration should be given, by those responsible for the design and the construction, to the safety of the workers and the public who will subsequently be affected by the plant & machineries associated with the process of the erection of such structures.
- b) Architects, engineers and other professional persons, not to include anything in the design that would necessitate the use of unwarrantably dangerous structural procedures and undue hazards, which could be avoided by design modifications, should exercise care of safety in every process.
- c) Architects, Engineers and other professional persons should exercise with care not to include anything in the design that would necessitate the use of unsafe construction procedures and create undue hazards. These should be avoided by means of design modifications where necessary.
- d) It is also of the greatest importance that engineers should take into account the safety risk associated with the subsequent maintenance of plant where this would involve hazards.
- e) Safety and health facilities should be included in the design for such work to be performed with the minimum of risk.
- f) Measures should be taken to ensure that all necessary safety and health program are efficiently implemented and properly maintained.

### **1.10 Hazard Identification, Risk Assessment and Risk Control (HIRARC)**

- a) When planning method of work, a suitable and sufficient assessment should be carried out and recorded. Method, materials and equipment should be selected to remove or minimize risk from work. Employers are responsible to carry out the risk assessment.

- b) The principles of risk assessment listed below should be adhered to which determining methods and sequences of work:
- i. Identification of the hazards involved with the proposed work
  - ii. Assessment of the risk (likelihood and severity) of any potential harm arising
  - iii. Removal of risks, possibly by changing the proposed methods or processes
  - iv. Control of remaining risks
  - v. Review and if appropriate, update.

### **1.11 Emergency Response Plan**

- a) Emergency response plan should be established and maintained. This plan should identify the potential for accidents and emergency situations, and address the prevention of occupational safety and health risk associated with them. The plan should be made according to the size and nature of activity based on relevant international standard as per below ;
- i. Ensure that the necessary information, internal communication and coordination are provided to protect all people in the event of an emergency at the worksite.
  - ii. Provide information and communication with the relevant authorities and the neighbourhood and the emergency response services.
  - iii. Address first aid, fire-fighting and evacuation at construction sites.
  - iv. Provide relevant information and training to all members of the organization, at all level, including regular exercise in emergency response.

# **CHAPTER 2**

## **MAIN ENTRANCE, HOARDING AND SECURITY POST**

## Chapter 2 Main Entrance, Fence and Security Post

### 2.1 Introduction

- a) The purpose is to stabilize entrances to a construction site for control movement of visitors, clients, workers and vehicles.
- b) The security post and fencing of construction site is to ensure to safe guard the project site and maintain the safety of workers while keeping the general public out of the construction site.

### 2.2 Objective

- a) The purpose is to stabilize construction main entrance is to reduce or eliminate the disturbance or nuisance onto public rights-of way or streets. Construction main entrance shall be used at all points of construction access and egress.
- b) Perimeter fencing and security post to prevent the general public from entering a construction work zone.

### 2.3 Definition

- a) **Main Entrance** - A stabilized construction access is defined by a point of entrance/exit to a construction site that is stabilized to reduce by tracking of mud and dirt onto public roads by construction vehicles.
- b) **Hoarding** – Temporary fencing is an alternative to its permanent structures and when a fence is required on an interim basis or needed for storage, public safety or security, crowd control, or theft deterrence. Other uses are for temporary fencing include venue division at large events and priority is for public restriction on industrial construction sites. Temporary fencing is also often seen at special outdoor events, parking lots, and emergency/disaster relief sites.
- c) **Security Post** – Key point of location for security guard standby at construction areas.

### 2.4 Legal requirements

Factories and Machinery Act 1967 (Act 139)

- a) Building Operations and Work of Engineering Construction (safety) Regulation 1986,
  - i. Regulation 10 : Access to workplace
- b) Factories and Machinery (Safety, Health and Welfare) Regulations, 1970.
  - i. Regulation 7: Access to place of work

- c) Occupational Safety and Health Act 1994
  - i. Section 15 - General duties of employers and self-employed persons

## **2.5 Procedure**

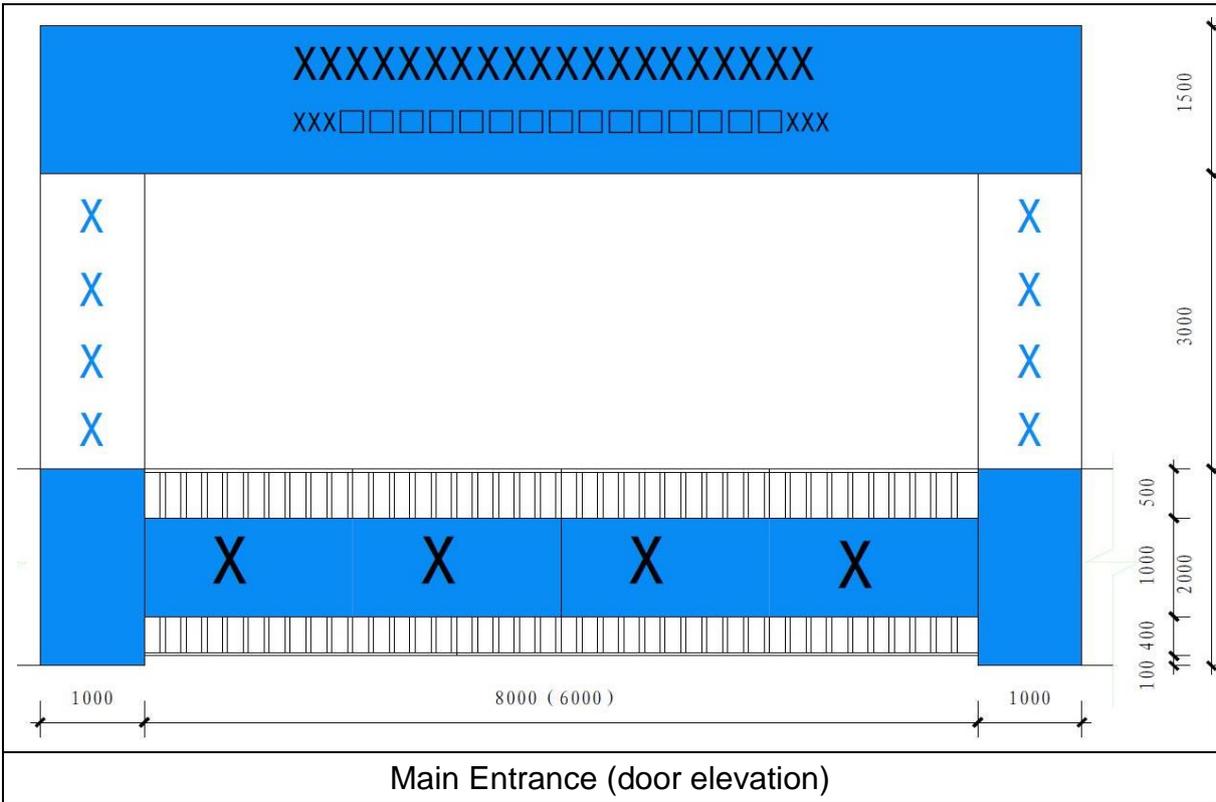
### **2.5.1 General Construction site**

- a) Review on safe construction workplace and cover all safety aspect from public safety issue.
- b) Construction site can be inherently dangerous with many changing and on-going risks including those associated with :-
  - i. Slips, trips and falls
  - ii. Temporary electrical installations
  - iii. Partially constructed structures.
  - iv. Stored construction materials
  - v. On-site plant and equipment.
  - vi. Where dirt or mud can be tracked onto public roads.
  - vii. Unstable soil conditions are encountered.
  - viii. Limited points of entrance/exit to the construction site.
  - ix. Limited speed of vehicles to control dust.
  - x. Proper water sedimentation for each construction to prevent run off dirty water flowing out of the construction site.
  - xi. Water route runoff from stabilized entrances/exits through a sediment-trapping device before discharge.
  - xii. Design stabilized entrance/exit to support the heavy vehicles and equipment.
  - xiii. Require all employees, subcontractors, and suppliers to utilize the stabilized construction access.

### **2.5.2 Door**

- a) Construction site should have the main entrances, entrances and exits should be of metal gates.
- b) The door is made of metal fabrication, and set the company name and slogan as required. Specific visual image according to the company standards. Gate can be divided into door-type gate with steel fasteners. The steel assembly type, recommended the use of steel assembly type gate, the enclosure can be made according to the actual situation to install the gate, but must ensure safety and meet the standards.

i. Recommended steel assembled door

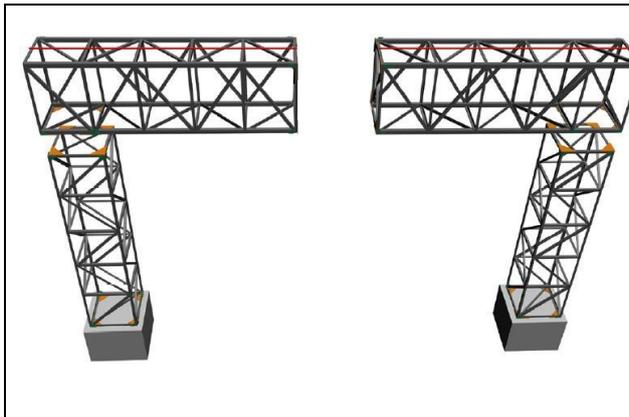


2.5.3 Main Entrance

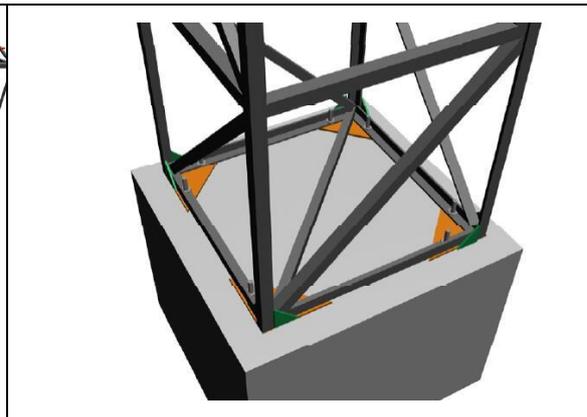
- a) The main entrance of the of the project site shall be in front of the project next to main road and close to the office area.
- b) The gate should have sufficient capacity and resistance to wind loads.



Best Practice on Occupational Safety and Health in Construction Industry 2019



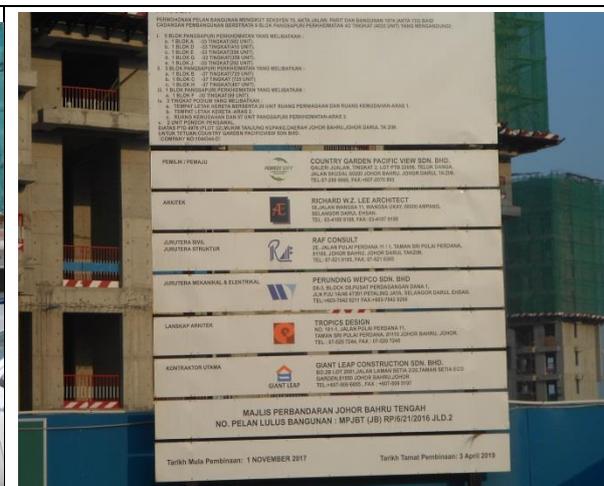
Main gate of entrance at construction site, internal components



Main gate door column base connection



Main entrance to construction site



Notice board of construction site



Workers enter the construction site



Safety sign at entrance

## 2.5.4 Gate at construction site

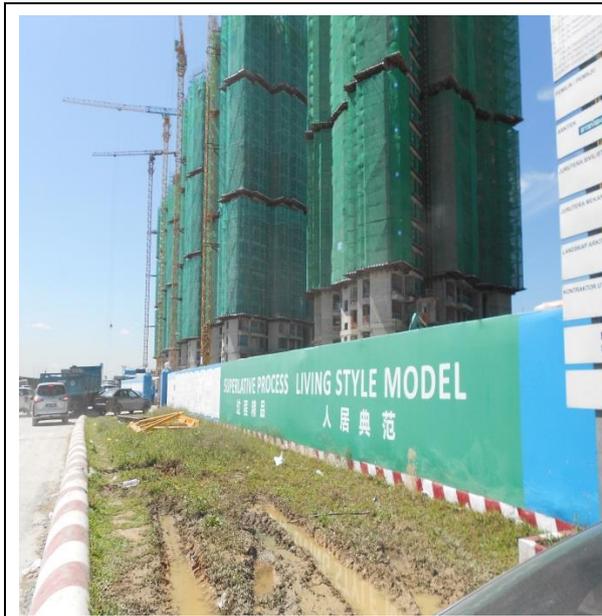
- a) The gate should be located at the construction site near security post.
- b) Security Officers on duty must wear uniform, establish a duty roster system, and implement the security personnel substitute system, the registration system for visitors and the vehicle entry and exit registration system.
- c) A certain number of helmets are to be kept in order to be distributed to those who need to go in the construction site to inspect, visit.
- d) To strengthen the security of personnel on the site, provide access to the construction site personnel to wear ID card. The non-related personnel is prohibited from entering the construction site.



## 2.5.5 Hoarding

- a) Security fence is used to control unauthorised personal entry onto a construction site.
- b) To be of a suitable height to deter entry (for example, at least 1.8 meters high)
- c) To be soundly constructed ( for example, gates and joints should be secure and not present a weak point for entry)
- d) Hoarding should be locked at all times when construction personnel are not present.
- e) To be stable and able to withstand anticipated loads or forces (for example, strong winds).
- f) Signs posted on the fencing perimeter need to warn intruders of the safety risk at those areas .
- g) Fencing with signage and shade cloth type coverings may require additional support to resist wind loadings.

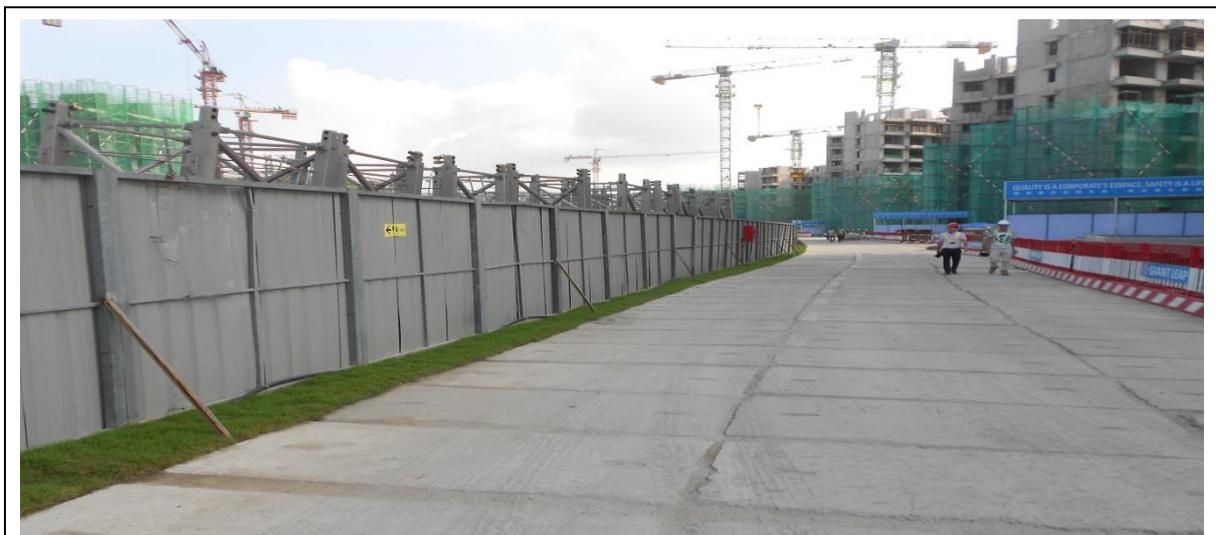
h) To be difficult to climb as well as preventing access from underneath.



Assembled wall (Fence)



Hoarding



Hoarding around construction areas

### 2.5.6 Security post

- A security post (also known as security booth and security building) at main entrance of construction site and keep security equipment.
- It is necessary to have a standby generator to maintain lighting.
- To keep track of all visitors and client by updating the log book on daily basis.
- Construction site with restricted access spaces, for instance, prefab security post may be used to ensure people don't enter hazardous areas.

- e) Security post are generally placed at the entrance as checkpoints for monitoring, observations and maintaining access control into construction site.
- f) In addition to reduce of sediment by simple friction of vehicle tires on the gravel pad, a vehicle washing station can be established at the site entrance. Wash stations, if used on a routine basis, remove a substantial amount of sediment from vehicles before they leave the site.



Main view of Security Post



Security Post



Security Post and entrance of workers.

# **CHAPTER 3**

# **WORKSPACE**

## Chapter 3 Workspace

### 3.1 Introduction

Every construction site usually provides a workspace for a worker to do their work. It is recommended to practice by using cabin as office. Every site is to provide with office area for smooth management. The office to be nearby the site area but isolated from construction site. Office area must be on the “Green Zone” to avoid any accident.

### 3.2 Objective

The objective of this chapter are:

- a) Understand the importance of site office.
- b) Determine the safe area for constructing site office.
- c) Ensure to meet the safety requirement, environmental requirement and fire protection.

### 3.3 Definition

- a) **Site Office** - A temporary administrative facility where business relating to specific property is conducted. This includes department office, meeting room, and first aid room.
- b) **Green Zone** - Safe area or open spaces that precautionary within defined limits where hazardous are at the lowest risk to the persons.
- c) **Work Station** - An area with equipment for the performance of a specialized task usually by single individual.
- d) **Ergonomic factor** - A study of human behaviour physically and psychologically in relation to particular environments, product or services.
- e) **Hydration** - The absorption of or combination with water. (Water consumption)
- f) **Lighting** - Arrangement of light used in a room to increase visibility.
- g) **Environmental Parameter** - A study to classify characteristic in environment that impact the survival, operation and growth of an organization.
- h) **Fire Protection** - Manual or automatic detection and suppression of fire.
- i) **Assembly Area** - A designated place where people have been told to wait after evacuating a building in case of emergency.

### **3.4 Legal Requirement**

Occupational Safety and Health Act 514:

- a) Section 15 : General duties of employers and self-employed person to their employees.
- b) Section 17 : General duties of employers and self-employed person to person other than their employees

Factory and Machinery Act 139:

- a) Safety Health and Welfare Regulation 1970
  - i. Regulation 6 : Floor
  - ii. Regulation 7 : Access to place of work
  - iii. Regulation 9 : Stairway
  - iv. Regulation 24: (1)Space of each person,(2) Height of work room
  - v. Regulation 25: Ventilation
  - vi. Regulation 29: Lighting
  - vii. Regulation 30: Seating facilities
  - viii. Regulation 31 : Work bench
  - ix. Regulation 34: Drinking water

### **3.5 Procedure and Type**

#### **3.5.1 Site Office**

##### **3.5.1.1 Location**

Location selection is the crucial part in the making of the office. There are many factor needed to be conceded before set up an office including:

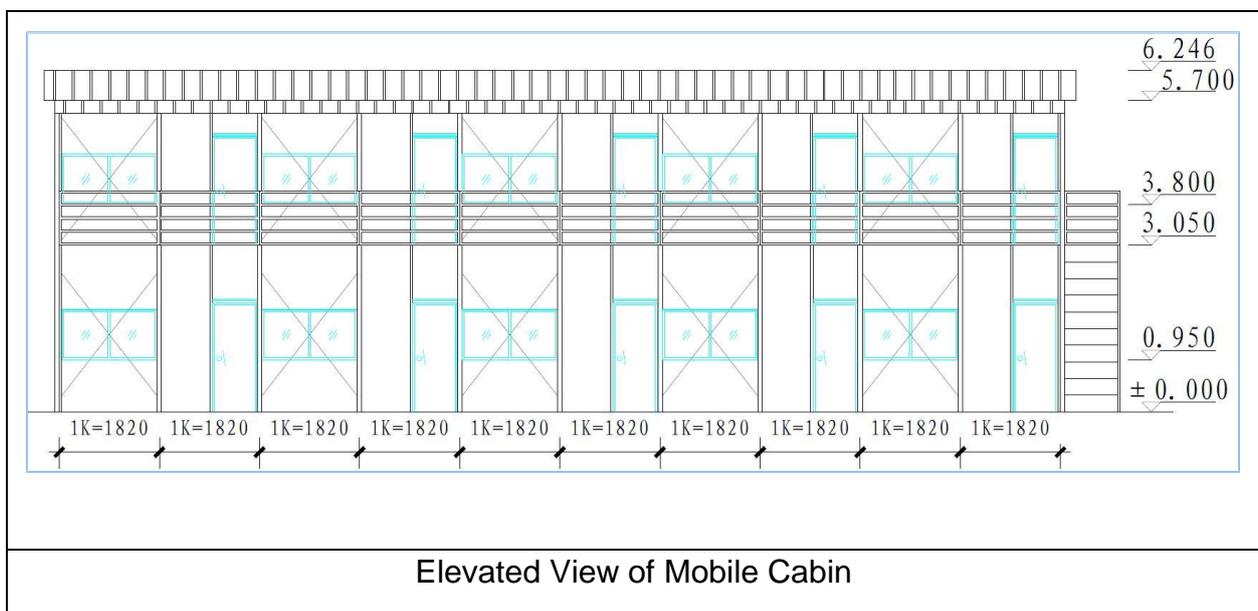
- a) Office area must isolate from operation area and must take the corresponding isolation measure but nearby the entrance of the operation area.
- b) Office area needs to be located outside the tower crane operation radius and any machinery to ensure protected from falling object.
- c) If the office areas are within the tower crane operation radius, the safety shelter must be erected in the corresponding range.
- d) Overhead electric lines should be maintain in safe distance to avoid electric shock
- e) To avoid from any kind of explosion, an office should be built far away from the high voltage transmission line.

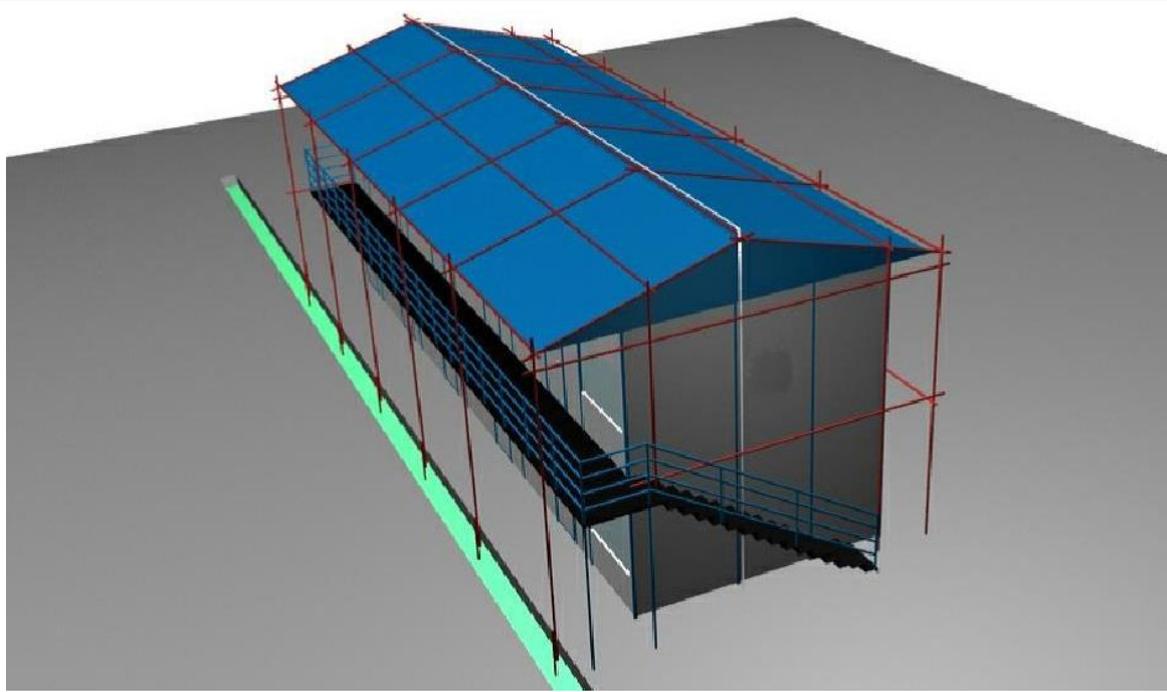
- f) Surrounding environment should be conceded as an office should not be constructed in dangerous area such as nearby cliff, mountain torrent, debris flow, low lying water area that can cause flooding, harmful gas or noise.
- g) Office area should be easier to access such as on roadside or as close as possible from existing traffic.

### 3.5.1.2 Office Structure

Most of the contractor in the construction business will use mobile cabin as their temporary office at the site. It is normally practice by using mobile cabin as temporary office the space between person/worker shall take into account. The specification of office structure are:

- a) Standard mobile cabin.
- b) The horizontal height of the indoor ground should be 50mm higher than the base level, in order to ensure sloping to prevent flooding inside ground office.
- c) All the electrical wiring must meet the standard requirements. All wires should cover with flame retardant conduit pipes.
- d) In order to improve the ability of wind resistance, choose the plank house of regular manufacturers, and strengthen it by adding steel pipe rack or wind rope to the board.





Mobile Cabin Reinforcement



Wind Rope

### 3.5.1.3 Office Requirement

To meet with the requirement of an office all the factor should be considered including:

a) Facilities (**Refer to Chapter 23 - Facilities**)

- i. All department and subcontractor have their own office.
- ii. Office are equipped with air-condition, network, photocopy machine, fax machine, water dispenser and the others office accessories.
- iii. Engineering department office should set up discussion table, drawing rack, and the others professional accessories.
- iv. Meeting room should be equipped with air conditioning, projector, multimedia equipment and others.
- v. Medical room are equipped with air conditioning, single bed, first aid area, emergency equipment and stretcher.

b) Ventilation

- i. Air enters office building or space through both mechanical ventilation system as well as naturally through window, door and etc.
- ii. The ceiling is installed with PVC ceiling. Interior height should not be less than 2.5 meters
- iii. Each window are install with window mesh to prevent mosquito and debris and steel grill to prevent from bugler.
- iv. Each office will provided with one air-condition to reduce heat.

	
Stainless Steel Grill	Mosquito and Debris Mesh

c) Lighting

- i. 2 windows install to provide proper illumination of an office on the day light which will provide more than 10% of the floor area.
- ii. Each office will install with lights that covered more than 300 lux

d) Workstation

- i. Each of the workers that working at the site will be provided with desk and chair to execute their work.
- ii. Each workstation was design with ergonomic consideration to ensure well-being of the workers.
- iii. There are multitude of discomfort which can result from ergonomically incorrect workstation set up such as neck pain, back pain and shoulder pain. **(Refer to Chapter 26 - Health Issue)**
- iv. Each chair provided with the proper back support and foot-rest to ensure work carried out without undue strain.
- v. Each workstation will be provided with an electrical supply plug. **(Refer to Chapter 16 - Mechanical and Electrical)**



e) General Water Dispenser Station

- i. Each department office will be provided with a water dispenser to ensure worker stay hydrated when working on extreme heat.
- ii. Heat stress is one of the health issue that will be faced when working at the site as the worker are going outside to execute their work. **(Refer to Chapter 26 - Health Issue).**

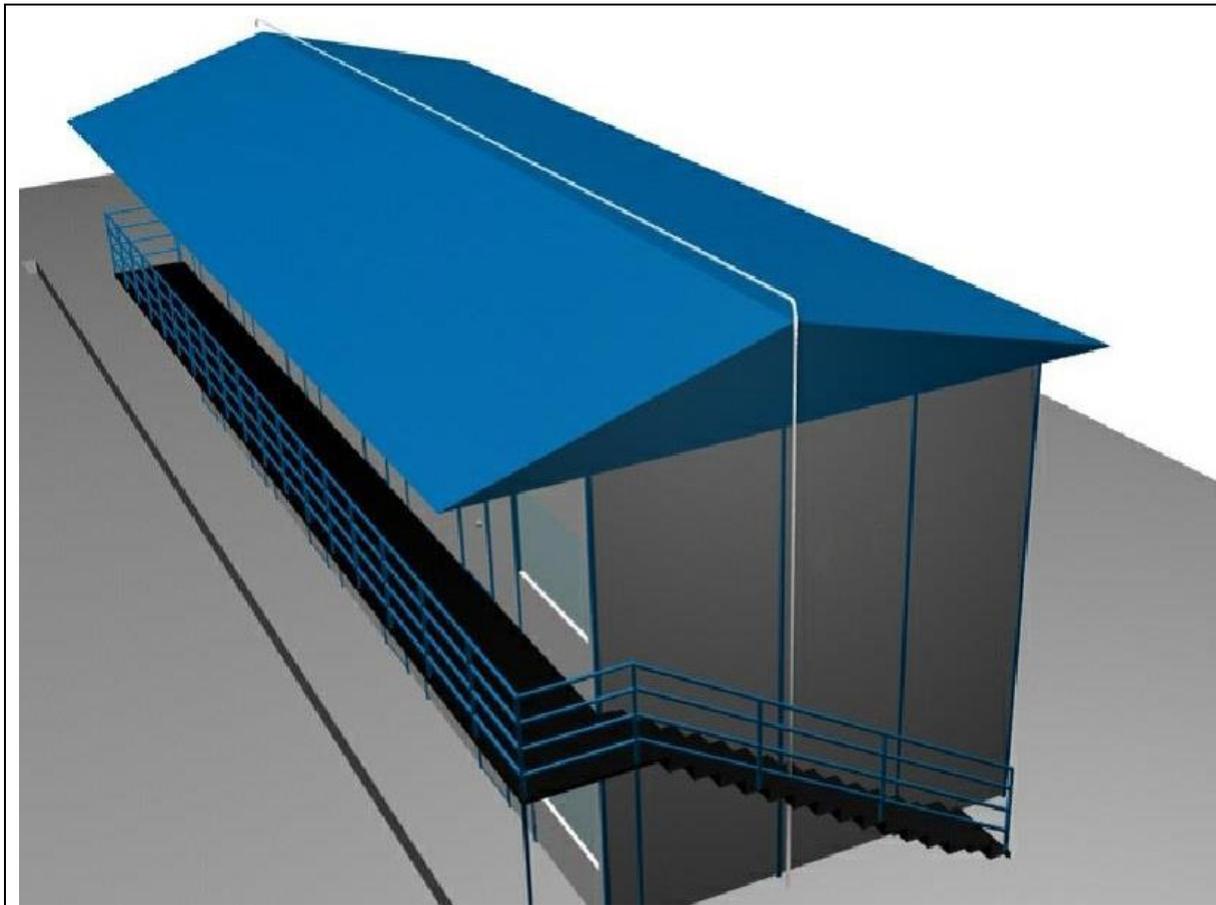


### 3.5.2 Environmental Parameter

The overall goal of environmental control is to provide an environment that clean, safe, comfort and peaceful. Excessively high or low temperature in an office area can lead to reduce productivity. High temperature has been associated with fatigue, lassitude, irritability, headache and decrease in performance, coordination and alertness.

a) Temperature

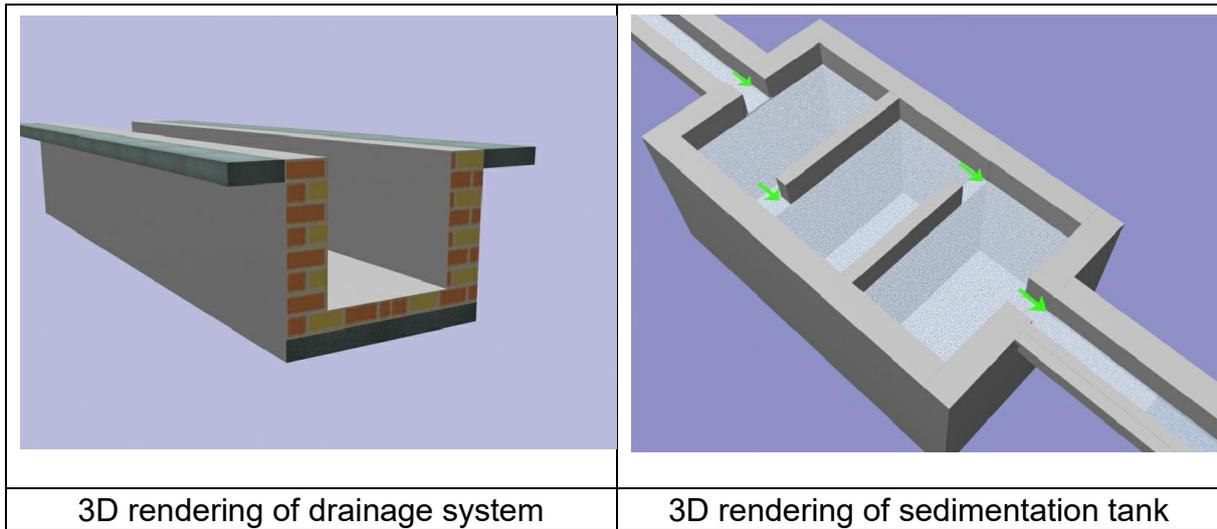
- i. During hot day or outdoor temperature can reached up to 35-37 °C. To reduce the heat generated from high temperature, the cabin are provided with water sprinkler or other cooling mechanism.
- ii. Spraying water should be clean, odourless, and comply health requirements. Water can be supplied from tap water, ground water, or spring water and etc.



Water pipe run along the roof to spray water when temperature is high

b) Drainage (*refer to Chapter 10 - Sewage and Drainage*)

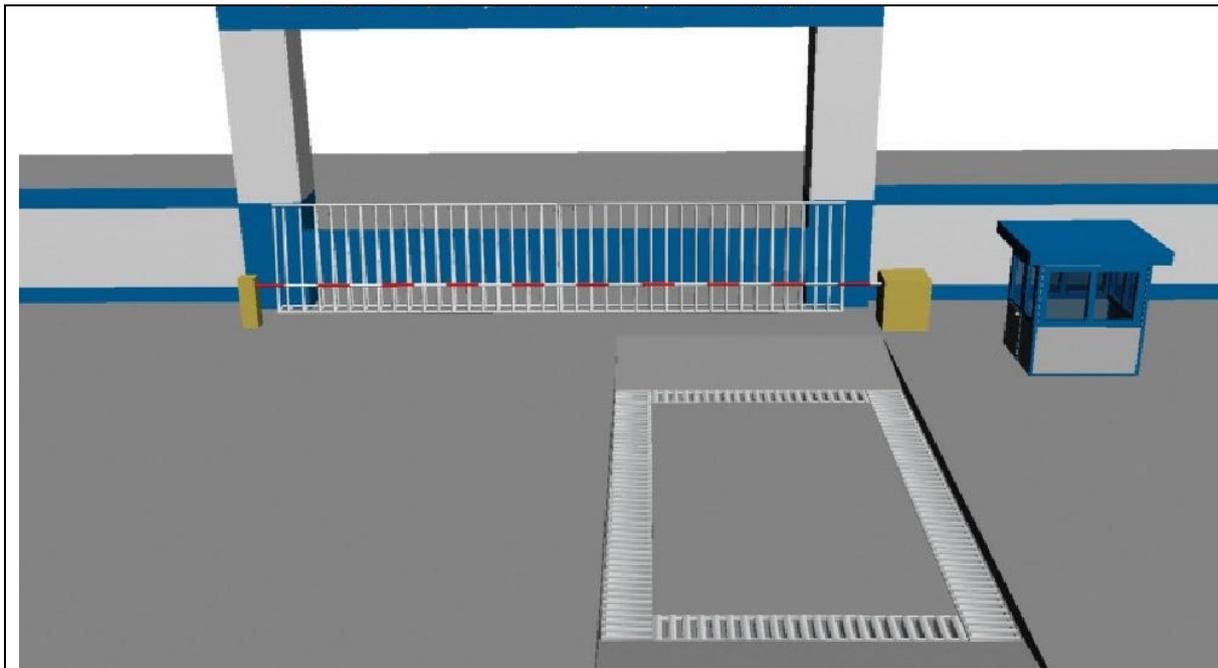
- i. The construction site should have a good drainage system to ensure smooth water flow drainage, no stagnant water on the ground.
- ii. It is forbidden to pour waste oil; poisonous and harmful substances directly into the drainage ditch and discharge it to the municipal pipe network.
- iii. Drainage brickwork, masonry surface with plastering treatment. Drainage width of not less than 0.3 meters in width, the depth of not less than 0.2 meters, and have a certain slope.
- iv. Construction site should be set up a reasonable sedimentation tank, no sewage without sedimentation, and treatment are not allowed to directly discharge to the municipal pipe or drain network.



c) Vehicle Wash Station

- i. Construction site must be set up vehicle wash tank, sedimentation tanks, and high pressure flushing device.
- ii. The vehicle wash tank is divided into two kinds according to different situations. The vehicle wash tank 1 is suitable for the entrance of the office living area that needs to go through the construction area; the ear vehicle wash tank 2 is suitable for the position of the entrance and exit of the worksite gate.
- iii. Vehicle washer base steel must strong enough to withstand the vehicle load. There is two type of vehicle wash station, one are automated and another are manually using general labour and water compressor.
- iv. Vehicle wash tank bottom and side should be plastering and the bottom should be not less than 2% of the drainage slope to ensure no flooding.





3D rendering of vehicle wash station base

d) Garden,-Rest Area and Smoking Area

- i. In front of the office area, there is a garden to ensure peaceful and stress free environment. This garden include with green grass, walkway, flower plant and flag pole.
- ii. Smoking area and rest area are provided with stool, table, rubbish can and water dispenser. This set up is to ensure safe, convenient and hygienic environment.



Garden Area

### **3.5.3 Assembly Area**

- a) The main goal of an evacuation is to facilitate the safe exit of people from the emergency site to bring them to a more secure location referred to the assembly area.
- b) This area is designated as safe areas that are away from harm when there are emergency happen.
- c) In designating assembly area, the distance from the site and size must be considered. It should be assessable and as close to the boundary of the evacuation area as possible.
- d) The assembly area must be safe and spacious enough in case of the basic first aid treatment done there. The space should be enough to accommodate tenants, personal, and member of emergency response team.
- e) In case of the first assembly area destination are inaccessible or block there must be a contingency assembly area. Informing tenants and staff about the exit route is futile if they don't have a clue on there to go after vacating the emergency site.

### **3.5.4 Fire Protection (*Refer to Chapter 6 - Fire Safety and Water Supply*)**

- a) Every office shall provide with adequate fire extinguisher.
- b) Proper maintenance and housekeeping are required to prevent fire.

# **CHAPTER 4**

# **OVERHEAD PROTECTION SHELTER**

## Chapter 4 - Overhead Protection Shelter

### 4.1 Introduction

A shelter is typically a simple, single-story roofed structure in the construction site that is used for storage, workshop, or even protection against falling object or rain. Shelters are vary considerably in the size and complexity depending on the needs and requirements. In this chapter we will discuss about the type of shelter that can be used in construction activity.

### 4.2 Objective

The objective of this chapter is to:

- a) Determine the type of shelter that can be used in construction site.
- b) Understand the importance of shelter in the construction site.
- c) Determine the best location for erection of shelter.
- d) Determine the best material to use in the making of shelter.

### 4.3 Definition

- a) **Work Area Processing Shelter** : Roofed workshop set up to protect worker from rain or falling object.
- b) **General Protection Shelter** : Roofed storage or shelter to protect worker or material from rain or falling object.
- c) **Rebar Yard Shelter** : Workshop for rebar bending used in reinforced concrete base flooring and roofed set up to protect worker from rain or falling object.
- d) **Distribution Board** : Known as breaker panel or electrical panel that devices an electrical power feed into subsidiary circuits, while providing a protective fuse in case of electrical overload.
- e) **Fabrication** : The action or process of manufacturing or inventing something.

### 4.4 Legal Requirement

#### Occupational Safety and Health Act 514:

- a) Section 15 : General duties of employers and self-employed person to their employees.
- b) Section 24 : General duties of employees at work

## **Factory and Machinery Act 139:**

### a) Safety Health and Welfare Regulation 1970

- i. Regulation 5 : Machinery installed on any floor above the ground level
- ii. Regulation 6 : Floor
- iii. Regulation 7 : Access to place of work
- iv. Regulation 20 : Stacking of materials
- v. Regulation 22 : Firefighting appliances
- vi. Regulation 23 : Cleanliness
- vii. Regulation 31 : Work bench
- viii. Regulation 32 : Work clothes, personal protective clothing and appliance

### b) Building Operation and Works of Engineering Construction (BOWEC)

- i. Regulation 6 : Machinery installed on any floor above the ground level
- ii. Regulation 10(2) : Well define access at the ground floor with overhead protection
- iii. Regulation 20 : Illumination of passageways
- iv. Regulation 21 : Storage of materials and equipment
- v. Regulation 119 : Material handling and storage, use and disposal
- vi. Regulation 122 : Material storage

## **4.5 Procedure and Type**

### **4.5.1 Work Area Processing Shelter**

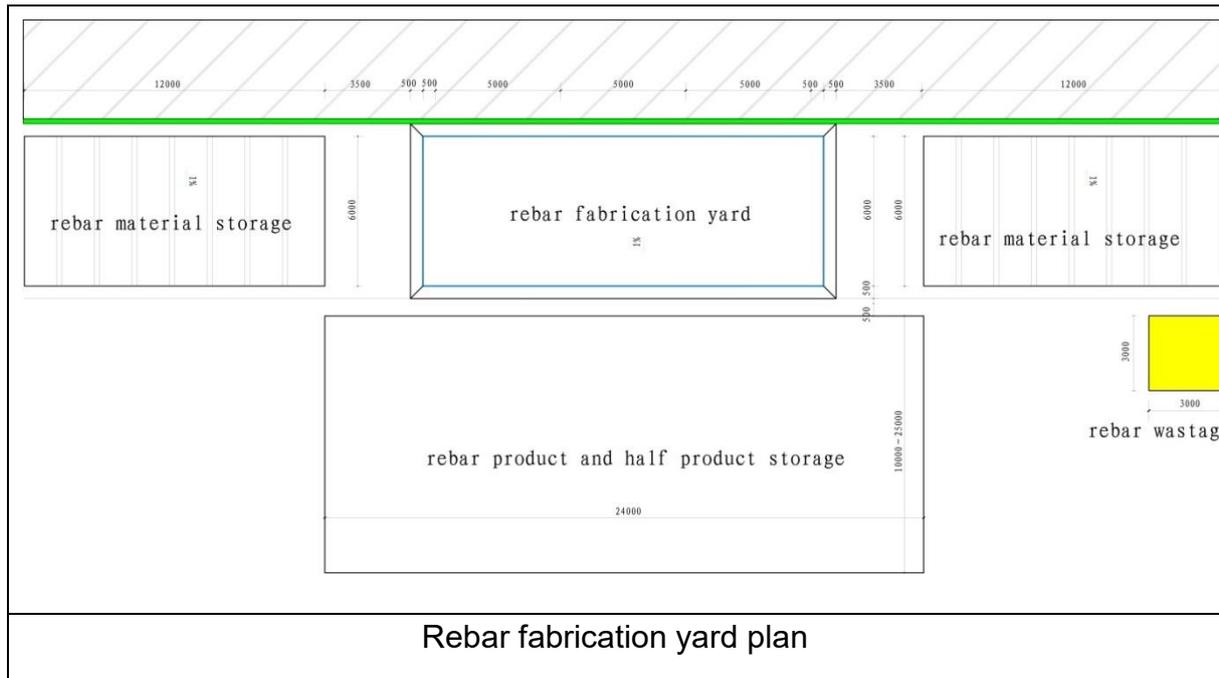
They are two type of work area processing shelter that commonly found in the construction site which is rebar fabrication yard and wood fabrication yard. This fabrication yard usually placed nearby tower crane due to there are a lot of hoisting activity needed such as hoisting fabricated material to the intended floor and unloading material from the lorry. In order to protect workers from the falling object that are exposed during hoisting activity, building a shelter are the best way to reduce the risk.

#### **4.5.1.1 Rebar Fabrication Yard**

Rebar fabrication is one of the crucial activities in construction activity. The steel bar used need to be bend according to the specification before being hoist to intended floor. This workshop set up within tower crane hoisting area. There are few aspect that need to be considered before building the rebar yard include:

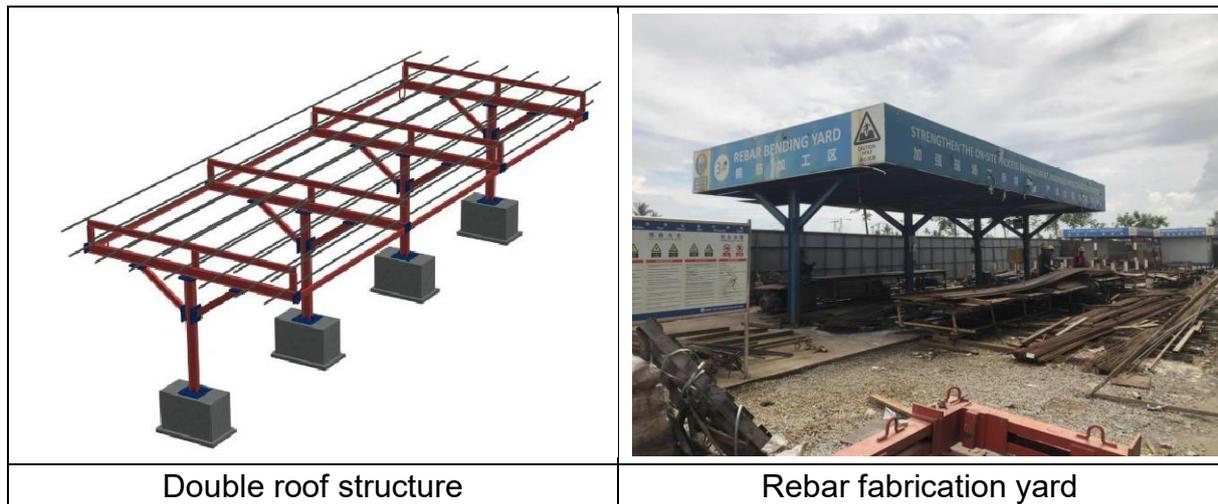
a) Location

- i. Rebar yard must be located within tower crane operation.
- ii. Rebar yard must be located nearby site road to ensure smoother loading and unloading material from lorry.
- iii. Material storage must be nearby or beside rebar bending machine.
- iv. Wastage area must be nearby to ensure proper housekeeping.
- v. This kind of fabrication yard can be on the other floor as long as that floor is strong enough to withstand the load.



b) Structure

- i. The columns are made up of I-beam with 5m space in between column and high of 3m.
- ii. Double roofing are used.



c) Material storage area

- i. Material storage area placed beside or nearby the rebar fabrication yard.
- ii. This area need to be barricade to separate the storage area from the site road and traffic.
- iii. Materials stacking are crucial issue that need to be consider at the storage area.
- iv. Every five bundle of the rebar will be pedestaled by hollow metal to support from collapsing.

d) Wastage Area

- i. Every rebar yard set up must have wastage area for the unwanted rebar metal.
- ii. This area is designated to ensure the working area were clean and away from the tripping hazard.
- iii. Workers need to do housekeeping 10 minute after work to keep the working area clean. (**Refer to Chapter 25 - Housekeeping**).
- iv. All rebar machines must provide with oil spill containment tray to prevent oil spillage on the floor and cause slippery floor.

e) Hazard Identification

- i. Activities in rebar yard require a lot of material handling and hoisting.
- ii. To ensure worker's safety, hazard must be identified to figure out the way to reduce the risk. (**Refer to table 1**).

f) Fire Protection (**Refer to Chapter 6 - Fire Safety and Water Supply**)

- i. Each rebar fabrication yard provided with 2 fire extinguishers.

NO	JOB DISCRIPTION /TASK	POTENTIAL HAZARD	EFFECT	RISK CONROL/RECOVERY MEASURE	ACTION BY
1	Hoisting material	Improper lifting	Fatal, fracture, contusion	<ul style="list-style-type: none"> <li>Conduct Toolbox meeting before start working.</li> <li>Only trained and competent Riggers, Signalman and Tower Crane Operator allowed to perform the task.</li> <li>Wear appropriate PPE including glove</li> </ul>	SHO SSS Site Supervisor
		Moving load	Fatal, fracture, contusion	<ul style="list-style-type: none"> <li>Use tag lines to control the load.</li> <li>Barricade loading and unloading area to prevent unauthorized personal into danger zone</li> <li>Refresh training for signalman, rigger and operator.</li> </ul>	Site Supervisor
		Falling object	Fatal, fracture, contusion	<ul style="list-style-type: none"> <li>All component brought up to height shall assemble immediately to prevent it from dropping accidently, do not place any loose component unattended.</li> </ul>	Site Supervisor
2	Rebar fabrication	Sharp object	Cut, bruise	<ul style="list-style-type: none"> <li>Provide worker with hand glove and safety goggle.</li> </ul>	Site Supervisor
		Caught between object	Contusion, bruise, cut, amputation	<ul style="list-style-type: none"> <li>To hoist or stack material properly and keep bodily parts away from moving load such to stationary object.</li> </ul>	Site Supervisor
3	Material handling	Awkward body position while loading material	Slip disc, back pain, muscle spasm	<ul style="list-style-type: none"> <li>Lift materials within personal capacity follow manual lifting procedure</li> <li>Adopt 2 man or more if lifting load beyond personal capacity</li> </ul>	Site Supervisor
		Sharp object	Cut, bruise	<ul style="list-style-type: none"> <li>Keep bodily part away from moving load.</li> </ul>	Site Supervisor

Table 1: HIRARC for Rebar Yard

#### 4.5.1.2 Wood Fabrication Yard

Woods are renewable resource for construction for as long as man recorded history. Wood properties offer several benefits that ideal for use such as biodegradable, economically feasible and the thermal properties of wood give advantage in high temperature surrounding.

a) Location

- i. Wood fabrication yard must be located within enclosed area to ensure the saw dust are isolated.
- ii. Usually wood fabrication yard located inside the building.
- iii. Raw material storage located beside the fabrication yard and the end product must be located nearby to ensure smooth operation
- iv. Wastage area must be provided to ensure the area are clean at all time.
- v. Safe access must be provided.

b) Structure

- i. The fabrication area.
- ii. Provide 2 ventilation fan for sufficient ventilation inside the fabrication yard.

c) Fabrication area

- i. All electric power tools shall be insulated to prevent electric shock.
- ii. All rotating tools must be guarded and inspect daily by site supervisor before start working.
- iii. Fabrication area must be clean daily to prevent obstruction and trip.
- iv. Saw dust must be collected and remove daily from the site.
- v. All nails shall be extracted and collected unless it is to be burned without further handling.

d) Hazard Identification

- i. Wood fabrication requires a lots of manual handling and cutting activity. Worker likely to expose to associated hazard.

e) Fire Protection (***Refer to Chapter 6 - Fire Safety and Water Supply***)

- i. Each rebar fabrication yard to be provided with 2 fire extinguishers

#### **4.5.2 Overhead Protection Shelter**

All building under construction of more than 2 stores high shall be provided with well-defined access at the ground floor with adequate overhead protective cover for persons entering or leaving the building. (BOWEC Reg 11)

##### **4.5.2.1 Safety Channel**

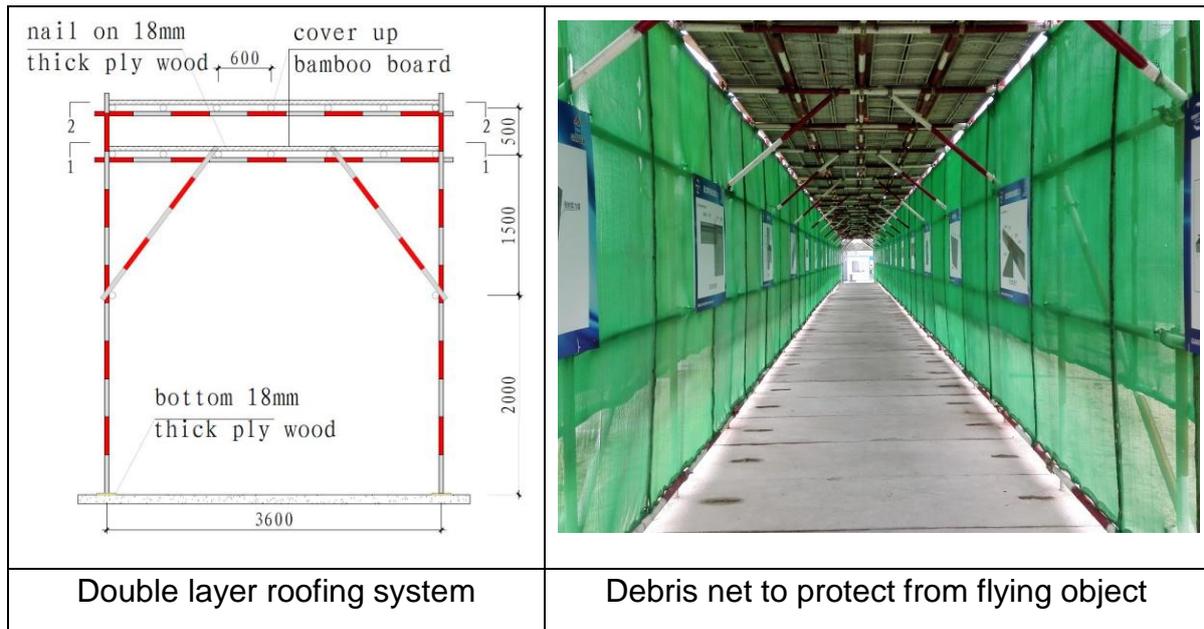
In addition to the use of safety helmet, employees must be protected by overhead protection shelter on the personal platform when employees are exposed to falling object.

###### a) Structure

- i. Every entrance of a building shall or within the building surrounding the hazard of falling objects radius shall install safety passage for worker to access.
- ii. Safe passage guard rails are to use steel pipe, the length of the channel should be based on the height of the building, following the table will show the building height to determine the radius after the fall.

Building height (H)	Falling radius (M)
2~5m	3m
5~15m	4m
15~30m	5m
>30m	6m

- iii. Safe passage shelter shall adopt double layer protection, the distance between the two layers is 800mm, and the upper layer shall be metal roofing and lower layers are cover by plywood.
- iv. The roofs are covered metal zinc
- v. Every side of the safe passage shall be covered with debris net to prevent hit by flying object.

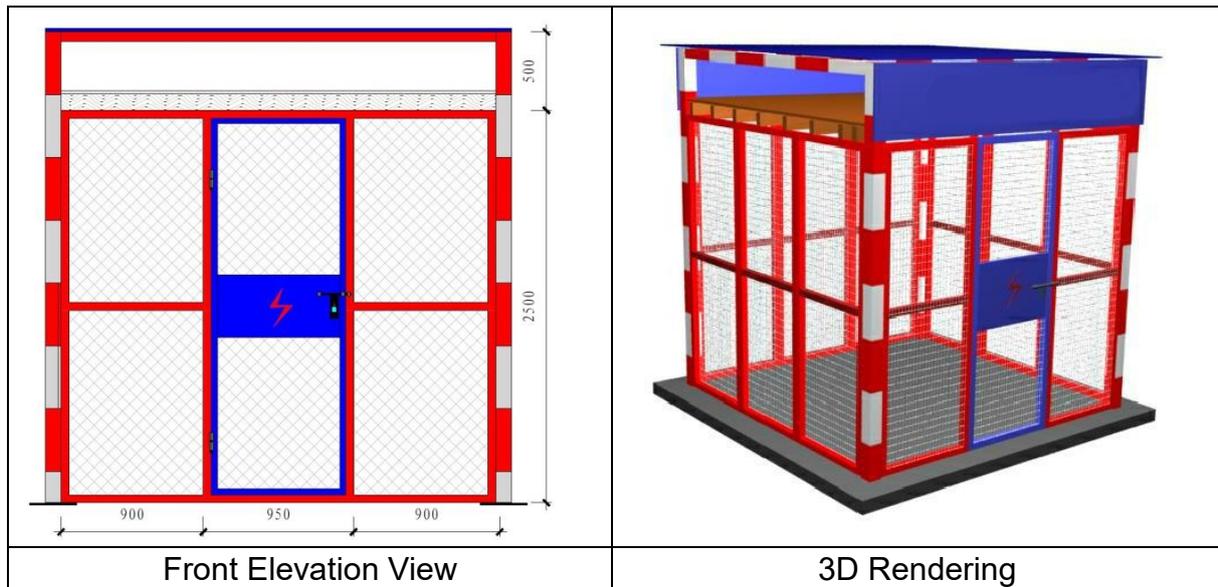


#### 4.5.2.2 Protection Shelter for Electrical Distribution Box

Electrical distribution box is a component of electricity supply system that divides an electrical power feed into subsidiary circuits while providing protective fuse or circuit breaker for each circuit in a common enclosure. This box need to be protected from water and to ensure continuity it must be protected from damage. Ensure all parts of electric power circuits are concealed to ensure no person, tool, machine become contact with electrical. For further understanding (*refer to Chapter 16 - Mechanical and Electrical*).

##### a) Structure

- i. The shelter must be enclosed and have a door to access.
- ii. As the recommendation double layer roof protection to ensure the roof is strong enough to withstand falling object which the upper layer are covered with 0.5mm metal zinc and the lower layer are covered with 20mm plywood.

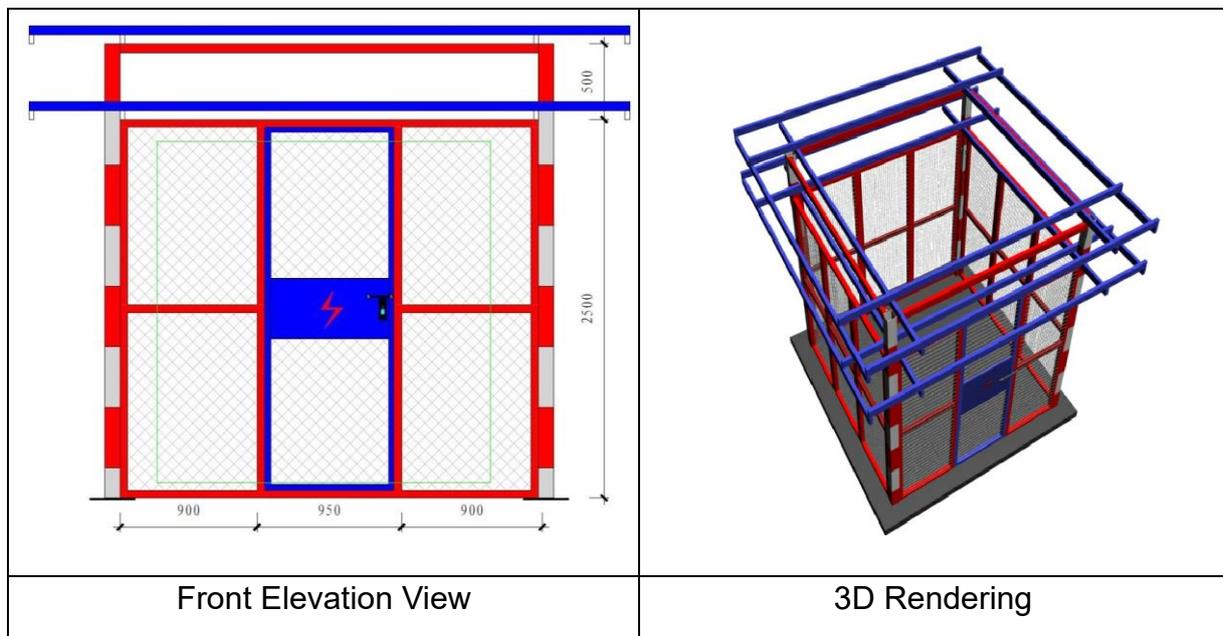


#### 4.5.2.3 Protection Shelter for the Bottom of Tower Crane

This protection shelter is to ensure safe access, protected from falling object and prevention from trespasser.

##### a) Structure

- i. The shelter must be enclosed and have a door to access
- ii. As the recommendation the roofs are two layered roofs that made from metal that enclosed around the mast to ensure the roof are strong enough to withstand the falling object.



# **CHAPTER 5**

# **TRAFFIC MANAGEMENT AND ROAD WORK**

## Chapter 5 Traffic Management and Road Work

### 5.1 Introduction

Traffic management is important for the organization, to arrange, guidance and control of vehicle traffic including pedestrians. It's aimed to provide safe, orderly and efficient movement of vehicles and persons where possible and enhance the smooth traffic movements.

### 5.2 Objective

The objective of this chapter are:

- a) Understand the importance of traffic management on site.
- b) Ensure safety and efficient traffic management system.
- c) Determine the speed limit, barricade the roadside work area, and the importance of flagman.

### 5.3 Definition

- a) **Flag Man** : Designated person who give the signals with flag to control traffic situation.
- b) **Competent Driver** : Designated license driver who are qualify to handle the vehicle.
- c) **Forklift** : Self – vehicle with a pronged device in front for lifting and carrying heavy loads
- d) **Visibility** : Quality or state of being see or been seen.
- e) **Walkway** : Any passage for walking, especially for pedestrians
- f) **Lighting** : Arrangement of light use to increase visibility.
- g) **Certificate of Fitness** : Document that certifies an individual or organization as being fit or competent to engage in particular work activity or industrial project.

## 5.4 Legal Requirement

### Occupational Safety and Health Act 514:

- a) Section 15 : General duties of employers and self-employed person to their employees.

### Factory and Machinery Act 139:

- a) Safety Health and Welfare Regulation 1970
  - i. Regulation 7 : Access to place of work
  - ii. Regulation 11 : Catwalk, runways and gangway
  - iii. Regulation 19 : Object on inclines
- b) Building Operation and Works of Engineering Construction (BOWEC)
  - i. Regulation 10 : Access to place of work
  - ii. Regulation 18 : Public vehicular traffic.**
  - iii. Regulation 20 : Illumination of passageways
  - iv. Regulation 58 : Use of vehicle
  - v. Regulation 59 : Use by employees
  - vi. Regulation 60 : Use by wheel-barrows
  - vii. Regulation 61 : Slope
- c) Person In Charge
  - i. Regulation 13 : Assessment of drivers
  - ii. Regulation 19 : Instruction to be given to persons working on machinery
  - iii. Regulation 20 : Training to be given to operators of certain machinery

## 5.5 Procedure

Managing traffic at a construction workplace is an important part of ensuring the workplace is without risks to health and safety. Vehicles including powered mobile plant moving in and around workplace, reversing, loading and unloading are often linked with death and injuries to workers and members of public.

### **5.5.1 Key Issue**

The most effective way to protect pedestrians is to eliminate traffic hazards. This can be done by designing the layout of workplace to eliminate interaction between pedestrian and vehicle by prohibiting vehicle from being used in pedestrian space or provide separate traffic route so that pedestrian not able to enter area where vehicles are used.

Key issues to consider for managing traffic at construction workplace include:

- a) Keeping pedestrian and vehicle apart including on site and when vehicle enter and exit the workplace.
- b) Minimising vehicle movement.
- c) Eliminating reversing vehicles or minimising the related risk.
- d) Ensuring vehicles and pedestrian are visible to each other.
- e) Using traffic sign.
- f) Developing and implementing a traffic management plan.'

The duty of employer includes implementing control measure to prevent people being injured by moving vehicles at the workplace.

### **5.5.2 Information, Training, Instruction and Supervision.**

The duty of employer is to provide necessary information, training, instruction or supervision (flagman) to protect all persons from risks to their safety and health. The workers must have necessary training, qualification or license to operate the vehicle, plant for example:

- a) Driving license, qualifications and required fitness for working.
- b) Managing the activities of visiting drivers
- c) Training drivers and operators.



The employer must ensure workers including contractors know and understand the traffic rules, safety policies and procedures for workplace. Visiting driver should be aware of restrictions on vehicle size or type before make delivery to the workplace. Other visitor take responsible care for their own safety and must take reasonable care not to adversely affect other people safety. They must comply, as far as practicable with reasonable instruction given by person in charge.

### **5.5.3 Keeping Pedestrians and Vehicles Apart.**

Consider implementing the following control measure to keep pedestrian and vehicle apart at the construction site and when vehicle enter or exit the workplace:

- a) Providing separate route for pedestrian and vehicle, where possible.
- b) Providing separate clearly marked pedestrian walkways that take a direct route.
- c) Creating pedestrian exclusion zone where powered mobile plant is operating.
- d) Creating vehicle exclusion zones for pedestrian-only areas, for example around rest area, facility amenities and pedestrian entrance.
- e) Securing vehicle operating by installing pedestrian barriers, traffic control barricade, chains, tape or billboard. Where needed ensure competent person with necessary training or qualified person to operate powered mobile plant near workers or other plant.
- f) Designating specific parking areas for worker's and visitor's vehicles outside the construction area.
- g) Providing clear sign and lit the crossing points where walkways across roadway so pedestrian and driver see each other clearly.

- h) Using traffic controllers, mirrors, stop signs or warning devices at site exits to make sure drivers can see and aware of the pedestrians before driving out onto public road.
- i) Avoid blocking walkways so pedestrians do not have to step into vehicle route.
- j) Scheduling work so that vehicle, powered mobile plant and pedestrians are not in the same area at the same time.



Separate pedestrian walkway



Construction car park area



Reflector mirror at the crossing point

### 5.5.4 Movement of Vehicular Traffic

In order to ensure safety of the worker from the vehicles traffic:

- a) All vehicles used at worksites shall be roadworthy and comply with the requirements of the Road Transport Department of Malaysia.
- b) No person shall drive a vehicle of any class or description in a construction worksite unless he is the holder of a driving license authorizing him to drive a vehicle of that class or description. (*Reg. 18(2)(b), Building Operations And Works Of Engineering Construction (Safety) Regulations, 1986*)
- c) The design of the traffic control shall comply with the standard set and controlled by the relevant authorities.
- d) Whenever any work is being performed over, or in close proximity to a highway or any other place where movement of vehicular traffic into and out of the work site may cause danger to the public, the working area shall be barricaded. Suitable and sufficient warning signs and warning lights shall be set up to direct traffic to slow down or away from it, and when necessary, the traffic shall be specially controlled by designated person. (*Reg. 18(1), Building Operations And Works Of Engineering Construction (Safety) Regulations, 1986*)
- e) Vehicles arriving at site and leaving site should be suitably scheduled to minimize congestion occurring on public road leading to the worksite.
- f) Vehicles should be parked in designated areas within the hoarded area while being loaded or unloaded.
- g) Where it is authorized by the local authority for vehicles ferrying materials to the worksite to be parked outside the hoarded area, suitable safety measures should be taken. Such measures should include cordoning off such parking areas and suitable warning signs, lights and flagman should be provided.
- h) Where it is absolutely necessary for construction machinery to carry out work from outside the hoarded area, the operating area of the machine outside the hoarded area should be cordoned off. Suitable warning signs and lights and flagman should be provided.
- i) Vehicles for carrying building materials, debris and excavated materials should be clean, well maintained and in good running condition. If they carry loose materials, they should be covered and properly sealed to ensure that there will be no spillage of materials onto the public road.
- j) Hazardous material should be rendered harmless and safe to be handled while transported on public roads.
- k) In residential areas, heavy vehicles engines should not be left idling unnecessarily so as to prevent a nuisance to the public at night and during public holidays.

- l) Vehicles should not be driven at speed exceeding the authorized speed limits.
- m) Vehicles should not be loaded beyond authorized load limits and all loose materials should be securely tied down before being transported.
- n) The main gate shall be attended by a flagman if it is located next to the main road to avoid accident.

### **5.5.5 Minimizing Vehicles Movement**

To limit the number of vehicle movement around the workplace:

- a) Planning storage areas so that delivery vehicles do not have to cross the site.
- b) Providing vehicle parking for workers and visitor away from the construction site.
- c) Controlling the entry to the construction site e.g.; using gates or security.
- d) Scheduling work to minimise the number of vehicle operating at the same area at the same time.

### **5.5.6 Reversing Vehicles**

Reversing vehicle are the most common cause of fatal incident. One-way road systems and turning circles can minimize risks especially in the storage area. Where this is not feasible other control measures should be considered including:

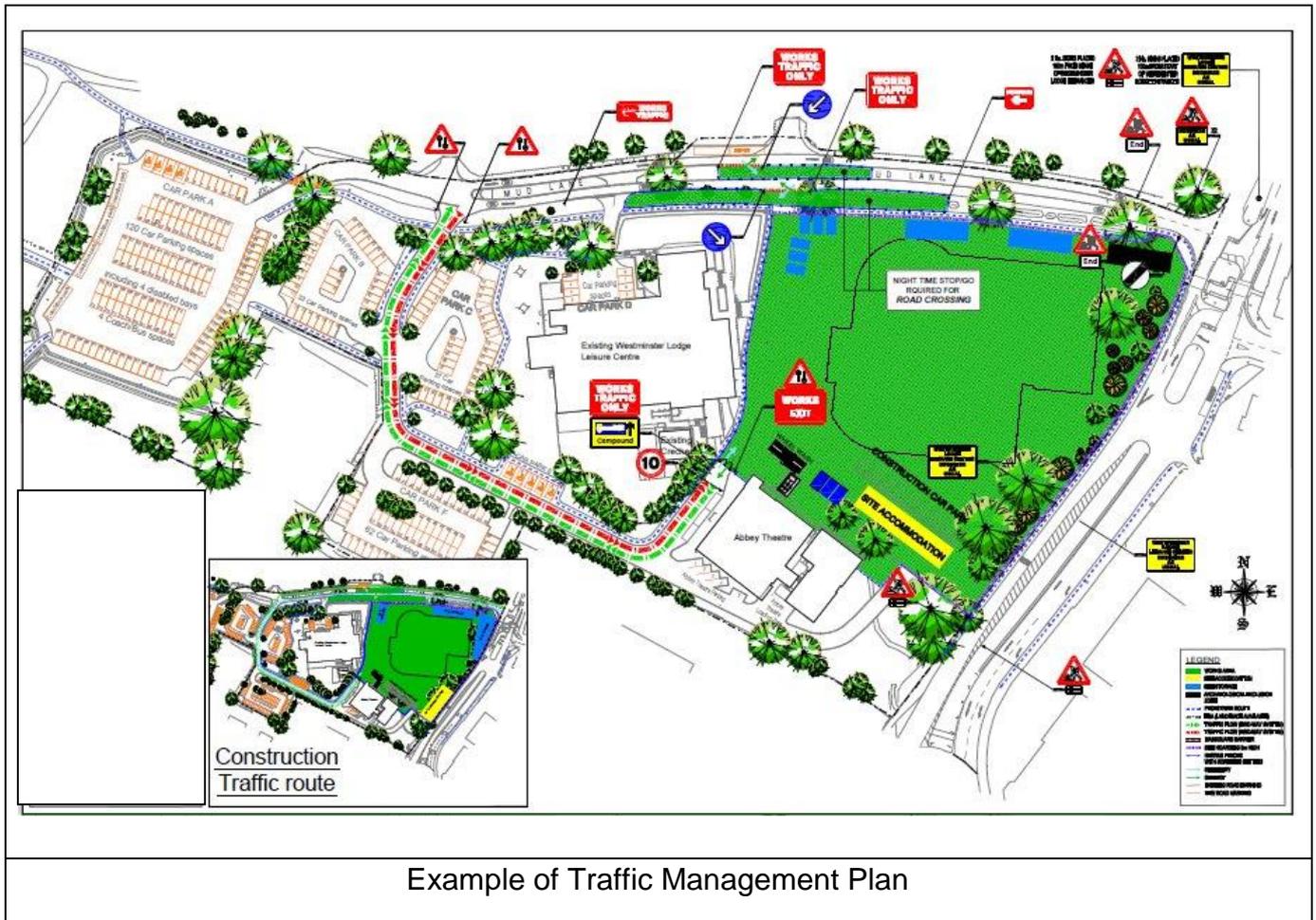
- a) Using mirrors, flagman, reversing warning alarms, sensors or camera.
- b) Ensuring the flagman wearing high visibility clothing to assist the driver who cannot see clearly behind their vehicle.
- c) Ensuring workers and other person are familiar with reversing areas and these areas must be clearly marked.
- d) Ensuring plant operators are aware of workers who may be in the vicinity of the swing radius, articulation point and overhead load movement of their vehicle.

### **4.5.7 Traffic Management Plan**

A traffic management plan documents and helps explain how risks will be managed at the construction workplace. This may include details of:

- a) Designated travel paths for vehicles including entry and exit point, haul routes for debris or plant and materials or traffic crossing.
- b) Pedestrian and traffic routes
- c) Designated delivery and loading and unloading areas.
- d) Travel path on routes remote from the workplace including places to turn around, dump material, access ramps and side roads.
- e) How often and where vehicles and pedestrian interact.

- f) Traffic control measure for each expected interaction including drawing of layout of barrier, walkways, signs and general arrangements to warn and guide traffic around, past or through the workplace or temporary hazard.
- g) Requirement for special vehicles like large vehicles and mobile cranes.
- h) The responsibilities of people managing traffic at the workplace.
- i) The responsibilities of people expected to interact with traffic at the workplace.
- j) Instructions or procedures for controlling traffic including in an emergency.
- k) How to implement and monitor the effectiveness of traffic management plan.



Example of Traffic Management Plan

### 5.5.8 Signs, Warning Devices and Visibility

Signs should be used to alert workers and pedestrians to potential hazards from vehicles entering and exiting the construction site. **(Refer to Chapter 22: Signage, Tags and Bulletin Board)**. Traffic routes should be clearly signed to indicate restricted parking, headroom, speed limits, and key area.

The following control measures should be considered to manage the risks:

- a) Installing mirrors, reversing cameras, sensors and alarms to help drivers see or be aware of movement around the vehicle.

- b) Installing visual warning devices like flashing lights and high-visibility markings for powered mobile plant.
- c) Implementing safe systems of work to stop loads being carried forward where they impair clear vision
- d) Appointing a trained person to control manoeuvre (flagman/signal man)
- e) Ensuring high-visibility or reflective clothing is worn by workers, plant operators and pedestrians at the workplace.
- f) Using communication method like:
  - a) Radio – however ensure a back-up communication process is in place if it fails.
  - b) Line of sight communication e.g.; hand signals or cap lamp light signals. The person receive the message should acknowledge the message has been received and understood.
  - c) Verbal commands and confirmation of warnings and signals.



Flagman

# **CHAPTER 6**

# **FIRE SAFETY AND WATER SUPPLY**

## Chapter 6 Fire Safety and Water Supply

### 6.1 Introduction

Every year there are many fires on construction sites and in buildings undergoing refurbishment; people are injured or killed, property is destroyed, including irreplaceable heritage buildings and the industry suffers disruption and unexpected costs from which many never recover.

Water for construction can be anything from welfare, water to flush toilets and wash hands, to storage sufficient amount of water, to keep processes running such as concrete mixing. For general used and production used of water on-site, should use general water supply to ensure water quality. For fire emergency used on-site, can use general water supply or natural sources (such as river water, river water, etc.), and the water source must be stable and reliable, meeting the water requirement for firefighting.

### 6.2 Objective

The objectives of this standard are to:

- a) Provide formal description on the requirement for temporary construction workers amenities.
- b) Ensure the welfare, safety, security and health of workers are properly provided and managed
- c) Provide a reference and guideline for the provision of workplace amenities and facilities that are reasonably practicable.
- d) Prevent fires and ensure good standards of fire safety management on construction sites.
- e) Prevented by designing out risk; the risk of fire can be reduced even further by taking a few simple precautions and ensuring that safe working practices are defined and complied with.
- f) Everyone working on site and provides information and guidance that will help to ensure that the risk of a fire is kept as low as practicable.
- g) Comply with relevant legislation and the requirements of BOMBA.

### 6.3 Definition

- a) **Access for firefighting** - means an unobstructed approach to the building including access to the fire route, fire hydrant(s), fire department connections, principal entrance and the means of egress for the occupants.
- b) **Access to exit** - means part of a means of egress within a floor area that provides access to an exit serving the floor area.

- c) **Assembly occupancy** - means the use of a building by a gathering of persons for civic, religious, social, educational, recreational purposes or for the consumption of food or drink.
- d) **Combustible material** - means material likely to ignite and continue to burn if exposed to an open flame.
- e) **Fire alarm system** - means an automatic or manual device designed to alert the occupants within a building to the presence of fire
- f) **Fire Drill** - means a practice exercise of the building's emergency fire procedure conducted to ensure all approved procedures and supervisory duties will be completed by owner, supervisory staff and occupants in the event of a fire.
- g) **Fire Hydrant** - means a device attached to the municipal water supply system, to provide a source of water for firefighting.
- h) **Fire Safety Plan** - means an approved document describing following:
  - i. The building description and schematic diagrams
  - ii. Occupancy type and human resources related to the building
  - iii. The emergency procedures, appointment and training of supervisory staff
  - iv. The control of fire hazards
  - v. A description of the life safety systems including the maintenance schedules and alternative procedures in the event that those systems become inoperative.
- i) **Safety signage** - Emergency or danger signs, warning signs or safety instructions that bear standard colours and sizes in accordance with the specifications for standard colours of sign for safety instructions and warnings in building premises.
- j) **Contaminant** – an undesirable substance not normally present, or an usually high concentration of a naturally occurring substance, in water, soil, or other environmental medium. In more restricted usage, a substance in water that may be harmful to human health.
- k) **Discharge** – the volume of water that passes a given point during a given period. It is an all-inclusive outflow term, describing a variety of flows such as from a pipe to a stream, or from a stream or river to a lake or ocean.
- l) **Pumping water level** – The water level in a well when the pump is operating and water is being withdrawn.
- m) **Sediment** – in the context of water quality, soil particles, sand, and minerals dislodged from the land and deposited into aquatic systems as a result of erosion.

- n) **Amenities** - The facilities provided or made available for the welfare of employees while they are at work, which include toilets, washing facilities (hand washing and showers), dining and changing facilities, facilities for personal locker, provision of drinking water, rest areas and seating.
- o) **Workplace** - Any construction site, where an employee or self-employed person works and includes any place such a person goes to while at work.

## 6.4 Legal Requirement

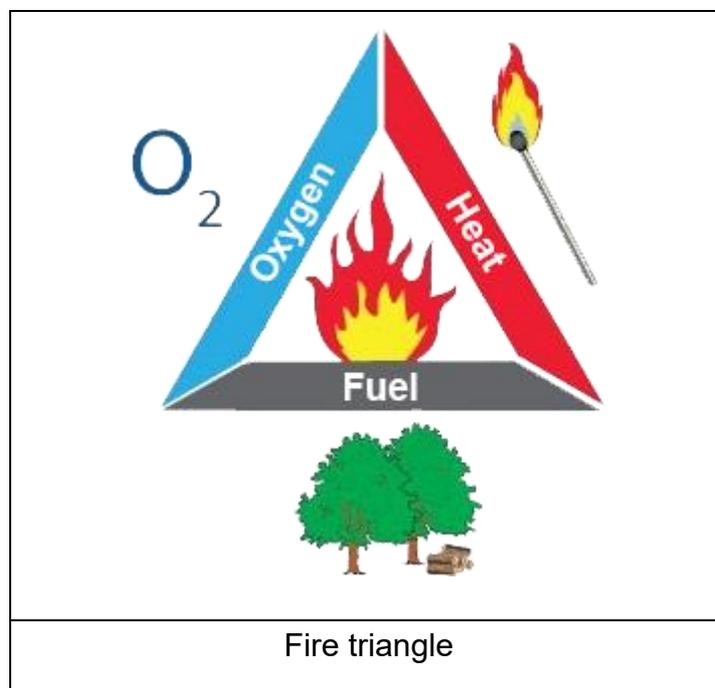
Factory and Machinery Act 139:

- a) Safety, Health and Welfare Regulations 1970
  - i. Regulation 15 : Containers for volatile inflammable substance
  - ii. Regulation 16 : Precaution against ignitions.
  - iii. Regulation 17 : Precaution with regard to explosive or Inflammable dust, fume or substance.
  - iv. Regulation 21` : Safety provision in case of fire.
  - v. Regulation 22 : Firefighting appliances
  - vi. Regulation 36 : Washing facilities
  - vii. Regulation 37 : Sanitary convenience
  
- b) Building Operations and Works of Engineering Construction Regulation 1986
  - i. Regulation 12 : Corrosive substance
  - ii. Regulation 16 : Electrical hazards
  - iii. Regulation 21 : Storage of materials and equipment
  - iv. Regulation 22 : Disposal of debris
  - v. Regulation 23 : Numbering and marking of floors
  
- c) Act 341: BOMBA Service Act 1988
- d) Act 581: Water Supply Act 1998

## 6.5 Procedure and Scope

### 6.5.1 Fire Safety

Fire risk can be defined as the product of the probability of occurrence of a fire to be expected in a given process or procedure, and the consequence or extent of damage to be expected on the occurrence of fire. Anyone familiar with risk assessment should also know the difference between a 'hazard' and a 'risk' - a hazard is defined as something with potential for injury and/or damage from fire and the presence of uncontrolled fire hazards affects the risk, i.e. the likelihood of fire, rather than the consequences of fire. In its simplest terms the management of fire hazard is found in the basic 'Fire Triangle' and this applies to the fuel and ignition hazards that can be found on construction sites - and eliminating one of the sides of the triangle will prevent fire from starting and being sustained.



#### 6.5.1.1 General Safety

##### a) Identify Hazards

The two areas where the site management can exercise control are with respect to ignition and fuel sources, if the hazard can be eliminated or controlled then the probability of fire starting and growing to a point where life is at risk is significantly reduced.

## b) Ignition Risks

The main ignition risks under management control are listed.

### i. **Electrical faults**

- ii. **Hot work** - hot works are defined as all "processes involving the generation of heat by a naked flame, electrical arc, sparks, and the use of bitumen boilers or grinding". Cutting operations may use open flame gas cutting equipment or disc cutting; acetylene should not be permitted on site unless absolutely necessary. A permit to work (PTW) should be obtained before commencing work; the permit must be specific to the work and closed when the work is complete. **(refer to Appendix for Hot Work Permit)**



- iii. **Smoking** - smoking is usually prohibited on site or designated smoking areas are provided away from the main work site and the site offices. **(refer to Chapter 22 Signage, Tags and Bulletin Board)**
- iv. **Temporary lighting and lamps** - where necessary the illumination of work areas is from temporary lighting installed or from specific task lighting. The hazards from such lighting come from placing light units too close to combustible items or not allowing the lamps to cool or from broken lamp units where hot surfaces are exposed. Lighting units should be secured in position away from combustible material to prevent them being dislodged.
- v. **Arson** - access to a site should be strictly controlled and supervised around the clock where necessary; there are many reasons given by an arsonist for starting a fire and the issue for the site management is to reduce the opportunity for an arsonist to strike. Management of waste is important as combustible materials present ready opportunities for arson.
- vi. **Lightning** - lightning protection systems shall be provided where appropriate and should be tested annually with certificates provided to confirm a satisfactory test.

### c) Fuel Hazards

Where combustible materials are used on site the provision of materials should be limited to those absolutely necessary or when appropriate those specifically designed for high risk sites. There are a variety of flammable materials with the potential to be stored or used on site that include scaffold boards and sheeting, temporary covering materials, waste that has been removed from building materials and bagged waste awaiting disposal.



- i. **Combustible building components** - the control of combustible materials is fundamental to site safety and materials should not exceed the quantities required for a day's work; storage of combustible items should be limited and a gap of 6-10m should be left between any fuel packages. Care should be taken not to leave any readily ignitable substances near to fuel packages.
- ii. **Flammable gases and liquids** - fuel may be required for hot cutting and plant and this may be in the form of flammable gases such as LPG or liquid fuel for generators. Management of fuel is the responsibility of the site manager and should include the whole process from procuring the correct fuel, its use and the potentially hazardous operations such as refueling. When combustible materials are being stored indoors the following guidance should be followed but not limited to:
  - The area should be regularly checked.
  - Access to the storage area should be controlled.
  - The storage area should not be in the work area.
  - The storage area should be covered by the site fire detection system.
  - Appropriate firefighting equipment should be located close to the storage area.

- iii. **Waste materials** - waste should be minimized wherever possible and disposed of as soon as possible. Packaging and waste materials from the work processes should be disposed of regularly and part of the management function should be to check areas for effective disposal in accordance with a Waste Management Plan for the site. **(refer Chapter 25 Housekeeping)**

#### **6.5.1.2 Understanding the Risk**

Understanding the risks associated with fire are essential to keeping a site safe from fire. Legislation requires that a suitable and sufficient Fire Risk Assessment (FRA) should be undertaken and maintained throughout construction work; all actions regarding Fire Safety should be as a result of the FRA:

- a) Identify hazards: consider how a fire could start and what could burn.
- b) Identify people at risk: employees, contractors, visitors and anyone who is vulnerable, e.g. people with disabilities.
- c) Evaluate and act: consider the hazards and people identified (above); act to remove and reduce or control residual risk to ensure people and premises are protected.
- d) Record, plan and train: keep a record of the risks and action taken. Make a clear plan for fire safety and ensure that people understand what they need to do in the event of a fire.

#### **6.5.1.3 Giving Warning**

There shall be a system to alert people on site. This may be a temporary or permanent mains operated, wired or wireless, fire alarm (tested weekly), a klaxon, bell, air horn or a whistle, depending on the size and complexity of the site. This list is not exhaustive. The warning needs to be distinctive, audible above other noise and recognizable by everyone. Where practical it should be demonstrated at induction.

#### **6.5.1.4 Fire Escape Routes**

As much as you may plan to prevent a fire occurring, in the event that one starts it is essential that all personnel in the area are able to escape quickly, easily and safely. Key aspects to providing safe means of escape on construction sites include:

- a) **Routes:** the safety team should evaluate the escape routes required - these must be kept available and unobstructed at all times.
- b) **Alternatives:** well-separated alternative routes to ground level should be provided where possible
- c) **Protection:** Wherever possible (and when a need is identified by the safety team) routes should be protected by installing permanent fire separation and fire doors as soon as possible prior to use.



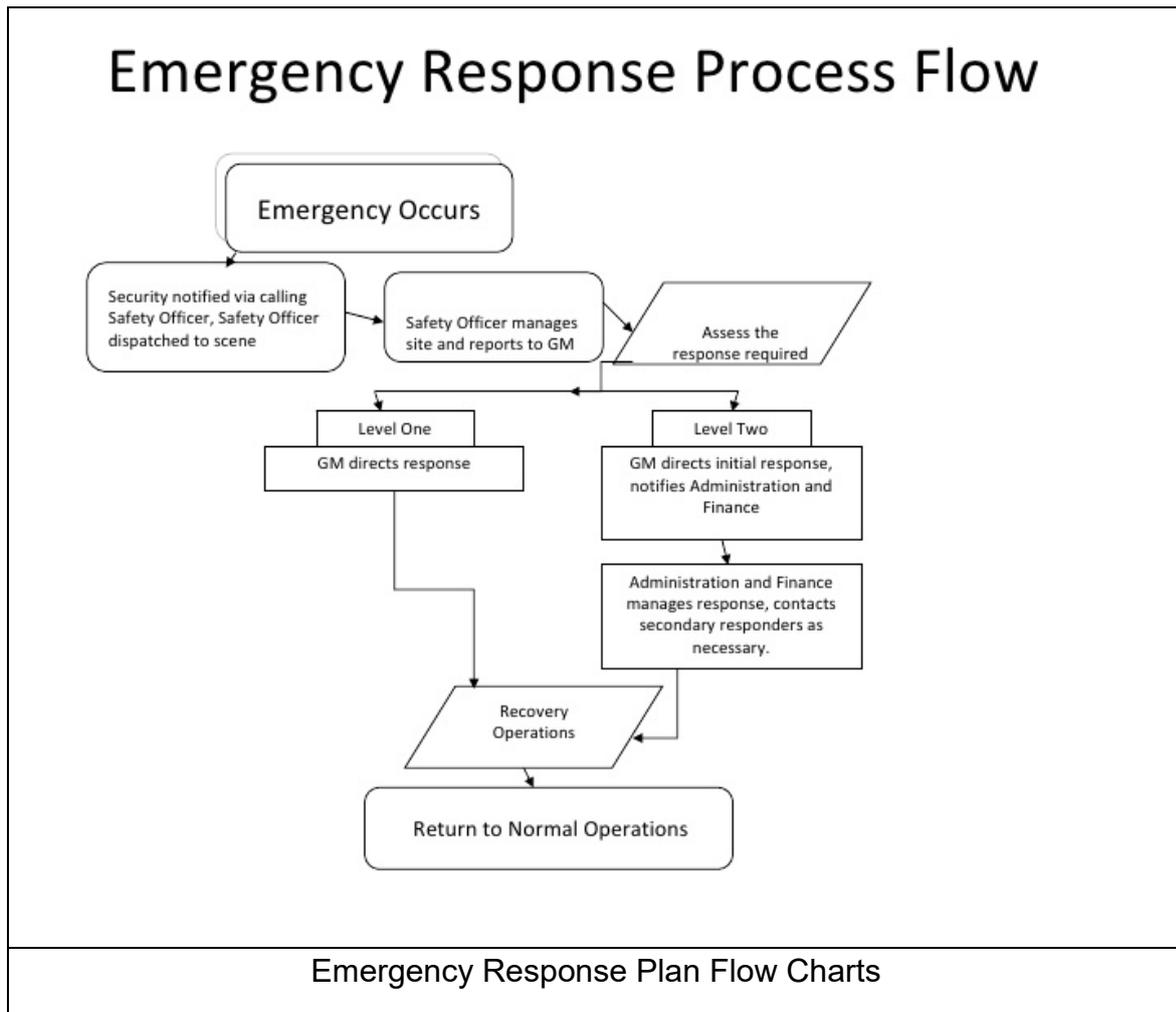
- d) **Assembly:** the escape route must have safe access to safe place away from the building where people can assemble and be accounted for.
- e) **Signs:** escape routes must be clearly identifiable and well signposted. Signage should be reviewed regularly to ensure it reflects the site layout
- f) **Lighting:** should be provided for enclosed escape routes and emergency lighting may be required.

### 6.5.1.5 Fire Safety Plan or Emergency Response Plan

The site safety plan should be developed from a site specific according to BOMBA requirement. It should be specific to the site and reviewed and updated periodically and should include the following as a minimum:

- a) The organisation and responsibilities for fire safety arrangements.
- b) Fire safety training for site operatives (including keeping training records).
- c) General site precautions, fire detection and alarm systems and emergency lighting.
- d) Fire extinguishers, general firefighting equipment and fire points.
- e) A requirement to maintain all forms of access (e.g. pedestrian, vehicular) to the site and buildings at all times.
- f) The need for fire escape routes associated with the construction including internal corridors and stairwells.
- g) The need for clear signage of all fire escape routes.

- h) A requirement for all fire escape routes to be kept clear of obstructions.



- i) The locations of any designated smoking areas. Smoking should generally be discouraged, absolutely prohibited in non-designated areas.
- j) The requirement for a hot works permit regime if hot works will be carried out.
- k) Temporary buildings and accommodation including location, fire protection, construction and maintenance.
- l) Communications – including a fire evacuation plan and arrangements for calling emergency services
- m) Fire and rescue services access, facilities and co-ordination.
- n) Instructions for anyone on site on actions to take in the event of a fire (including assembly point location).
- o) Security measures to minimise the risk of arson.
- p) Material storage arrangements with particular reference to flammable materials.
- q) Waste storage arrangements with particular reference to flammable materials.
- r) Maintenance arrangements for electrical installations (including temporary installations).
- s) The use of fire retardant coverings as deemed necessary.

- t) Arrangements for plant and vehicles (e.g. fire suppressants).
- u) Measures to prevent fire spread from the site to adjoining areas.
- v) Housekeeping requirements – waste and clutter can present a fire risk. **(refer to Chapter 25 Housekeeping)**
- w) Appropriate segregation of materials.

#### **6.5.1.6 Fire Marshal**

- a) The Principal Contractor should appoint a Fire Marshal, Deputy Fire Marshal and Fire Wardens, to assist in the implementation of the site fire safety plan.
- b) The number of Fire Marshals etc. required will be dependent on the findings of the safety team.
- c) The number of Fire Marshals, Deputy Fire Marshals and Fire Wardens should be determined by the safety team and should take into account the size and organisation of the project.
- d) Fire Marshals, Deputy Fire Marshals and Fire Wardens should receive adequate training to ensure that they are competent to carry out their duties.
- e) They should have sufficient status and authority to enable them to carry out their duties effectively.
- f) Duties of Fire Marshals, Deputy Fire Marshals and Fire Wardens should be clearly defined in an appointment letter.

#### **6.5.1.7 Fire Protection**

The project should, wherever possible, be designed to enable the early installation and operation of:

- a) Permanent fire escape stairs (including fire compartment walls).
- b) Fire compartments within the building including fire doors and fire stopping.
- c) Structural steelwork fire protection.
- d) Firefighting shafts – these should be commissioned and maintained.
- e) Lightning conductors.
- f) Automatic fire detection systems (where these are planned to be installed).
- g) Automatic suppression systems and other fixed firefighting equipment.
- h) Temporary emergency lighting (prior to the installation of permanent emergency lighting).



Adequate supplies of water should be made available for firefighting; these should be made available as part of site mobilization and reviewed at appropriate times throughout the works. The following should be considered when setting up water supplies:

- Any extensions to the fire hydrant main should be installed as early as possible.
- Distance of fire main from source and resultant water pressure reduction must be considered – and addressed as appropriate.
- Rising and temporary mains must be provided where planned.
- If it is necessary to move the fire brigade inlet point, information on the new location must be readily available.
- Periodic testing of water supplies should be carried out; testing records should be maintained.
- All hydrants must be suitably marked and kept clear of obstructions.

Appropriate fire extinguishers (e.g. CO<sub>2</sub>) should be within the vicinity of distribution panels and other items of electrical equipment. Clear signs relating to fire safety issues must be installed and maintained in prominent locations. These signs include:

- Fire and rescue services access routes.
- Fire Action Notices.
- Escape routes.
- Positions of dry riser inlets.
- Fire extinguishers.
- Fire alarms call points.
- Manually operated devices for raising the alarm.

Signs should be reviewed regularly and replaced or repositioned as necessary (**refer to Chapter 22 Signage, Tags and Bulletin Board**). Fire checks should be undertaken at the end of each working day, especially in areas where hot work has been carried out. No part of a building should become permanently occupied until all fire protection and control measures have been installed, tested and, where appropriate, commissioned.

### 6.5.2 Temporary Water Supply

Almost any kind of construction project needs water, if not to mix the mortar then to brew the tea. It is self-evident that what might be considered acceptable for one might not be for the other. Providing a source of wholesome water and keeping it that way can be a significant challenge in the early phases of a large construction project. Large bottle water coolers have become common in site cabins but probably not an economic solution for showers or large scale catering, not to mention toilets. At some point in most construction projects there either has to be connection to the local water main or provision of water by tanker.

#### 6.5.2.1 Temporary Water Supply Application from Provider

Application of water supply can be done following the State water provider. In Johor the application done by application through Syarikat Air Johor, Ranhill Sdn Bhd. The following are the documentation needed for the application. Refer to table 1:

Company	Company Owner	<ul style="list-style-type: none"><li>· Identification Card for Director</li><li>· Sale and Purchase Agreement</li><li>· Company Registration Certificate (SSM)</li><li>· Form 24 &amp; 49</li><li>· Bank Guarantee (for use from RM100K)</li><li>· Authorization letter (on behalf)</li><li>· Setem Hasil RM10.00</li></ul>
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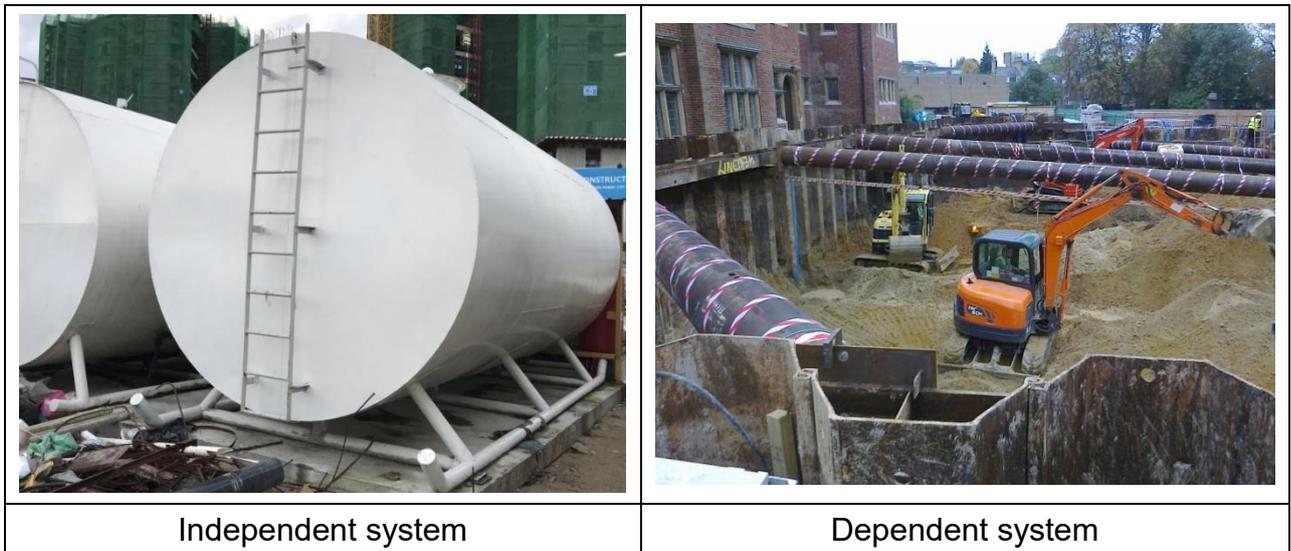
Table 1: Application of Water Supply

The guidelines for application can be download from the water state provider.

### 6.5.2.2 Type of Temporary Water Supply

Temporary water supply systems are classified into two types:

- a) **Independent** — i.e., not connected with any other water supply system and with its own facilities from source to service taps.
  - b) **Dependent** — i.e., receiving treated water through a pipeline from an existing community water supply system but with independent distribution facilities.
- Approaches to drinking-water safety in these two types of temporary supply differ.



The risk of drinking-water contamination in an independent temporary water supply system is usually higher than in a dependent system, because none of the components of an independent system are well established or have a track record on safety through long-term operation. Therefore, more attention will be needed in the case of an independent system compared with a dependent system. It is common in the case of a temporary water supply that a contract is made between the organizer of an event (e.g., construction) and a water supply entity.

### 6.5.2.3 Planning and Design

There are a variety of temporary water supply systems. These can vary in terms of their scale, period of operation, water use, time-dependent water demand and dependence on an existing community water supply system. These factors should be taken into consideration during the planning and design stages. In the case of an independent system (i.e., not associated with an existing public system), adequate consideration should be given to the selection of a water source and treatment processes.

- a) For general used and production used of water on-site, should use general water supply to ensure water quality. For fire emergency used on-site, can use general water supply or natural sources (such as river water, river water, etc.), and the water source must be stable and reliable, meeting the water requirement for firefighting.
- b) Water distribution layout shall be shorter as possible under conditions of ensuring uninterrupted water supply, At the same time, the possibility of moving of pipe should be considered during construction,. Pipe of general use and office area should use PPR pipe, and the pipe for drainage should use PVC. At the construction site, the fire emergency water supply system should be combined with general water supply system and for construction site operations use. Fire water tank diameter should not be less than diameter 100mm. For temporary plumbing, exposed pipe or concealed pipe can be used.

#### **6.5.2.4 Operation and Maintenance**

- a) A temporary water supply system should be properly operated and maintained so that the supplied water quality does not deteriorate.
- b) It should be noted that a temporary water supply system is usually more vulnerable to accidental and deliberate contamination than an existing community water supply system.
- c) Therefore, adequate attention needs to be paid to security.
- d) It is recommended that an operation and maintenance manual be prepared before the operation of a temporary water supply system is initiated.
- e) The most important issue for operation and maintenance is disinfection.



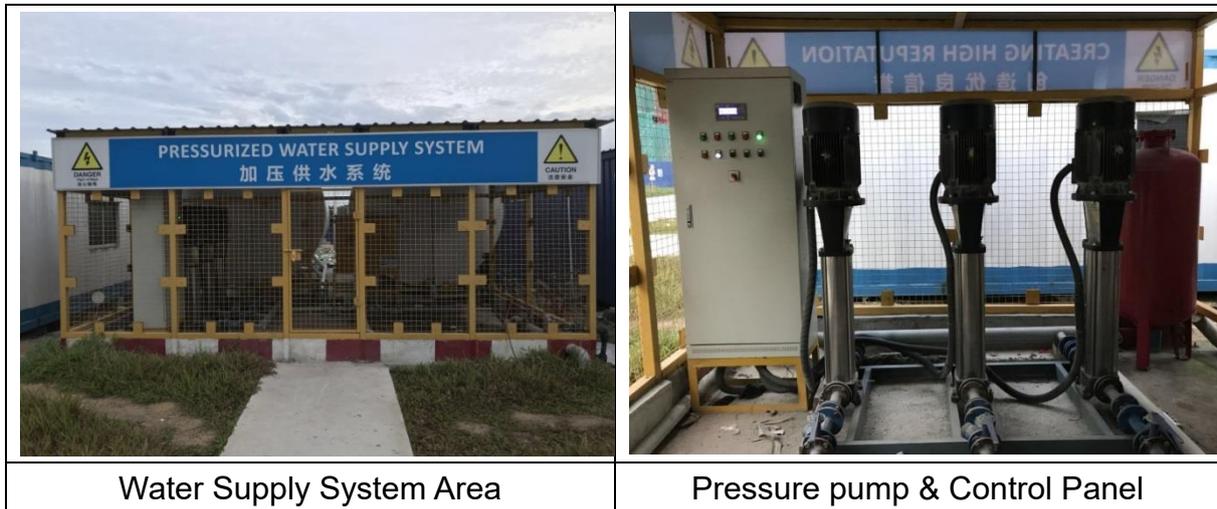
Water supply pipe

- f) All water treatment facilities should be thoroughly inspected at least every day. It is recommended that signboards be installed beside each service tap with instructions on what the water can and cannot be used for and the measures to be taken when using the water.
- g) Instructions on hand-washing before preparing foods and fresh drinks are extremely important.
- h) It is also recommended that suitable signs be installed around water sources indicating requirements for source water protection.
- i) Workers should be required to use proper sanitary facilities.

#### 6.5.2.5 Water Pressure Control System

- a) Water pressure control system equipment is the AC variable frequency speed control technology and computer control technology used in automatic pump control equipment, and combined with the pump unit of mechatronic water supply device. Its core equipment of AC variable frequency speed control panel combines the advanced computer-controlled variable frequency speed control technology, advanced computer-controlled PID regulator technology and advanced computer programmable logic controller and other current international advanced technology.
- b) Water pressure control system equipment mainly controlled by the control panel, pressure sensors, pumps and other components. The control panel occupied with circuit breakers, inverters, contactors, intermediate relays, PLC and other components.
- c) The advantages of water pressure control system water supply is, no need to build water tower, small investment, small land for facilities, automatic operation, automatic connection of tap water, and energy saving. The water supply still can continue even after power failure. From the construction of the water tower save up to 70% of investment compared to the high water tank save up to 60% only of the investment, good saving for civil investment.
  - i. **Significant economic benefits:** The use of the equipment, operate without the construction of water towers, roofless water tanks. It's not only to reduce the construction cycle, but also to solve the shortcomings of high cost of the project and also to overcome the pressure fluctuations, frequent start and other shortcomings of the pump.
  - ii. **Rigorous design:** The equipment uses constant pressure pump control, no matter how the system changes in water consumption, can make the pipeline outlet pressure remains constant.

- iii. **Reliable operation:** The device adopts the inverter and high-quality pumps with perfect protection and automatic and manual conversion functions so that the operation is very reliable, good performance, flexible control, and anti-interference ability.



- iv. **Energy-efficiency:** The device can adjust the pump speed according to the change of user's water consumption; make the pump always work in the high-efficiency area, and saving energy which can save up to 35% electricity than the constant speed pump.
- v. **Simplify operation:** The device uses fully automatic control, PID adjustment, keyboard operation, human-machine interface (text, numbers) display. Operators simply switch panel switch, you can achieve the desired user conditions automatic unmanned.
- vi. **Complete protection:** from over-load, short circuit, over-voltage, low-voltage, phase loss, over-current, short circuit, water shortage and other automatic protection.
- vii. In exceptional circumstances can signal alarm, self-test, fault judgment.
- viii. **Small footprint and easy installation:** the entire set of equipment is only a water supply control panel and pump unit, the installation is very simple and convenient.
- ix. **Extend the service life of pumps and motors:** Reliably achieve soft start for multiple pump sets, avoid impact on power grids and pipelines, and operate in turn, greatly extending the service life of pumps and motors.
- x. **Selection of non-tower water supply system:** According to the project size, height, design flow, and other parameters provided to the equipment suppliers, manufacturers with matching.

- xi.** Tank capacity should be greater than the maximum amount of water per hour. According to the size of the project to calculate the production of water, domestic water consumption and fire water, according to the total amount of water to determine the size of the tank capacity.
- xii.** Main pump should be greater than the actual water supply height. The total pump flow should be greater than the actual maximum water supply.
- xiii.** Water pressure Control Panel Selection: According to the water supply and water supply height to determine the type and number of pumps, and then control panel selection, matching by the manufacturers.

#### **6.5.2.6 Monitoring, Sanitary Inspection and Surveillance**

- a) Water quality and appearance should be routinely monitored at the service tap of a temporary water supply system.
- b) It is recommended that, at the very least, water temperature and disinfectant residual should be monitored every day as simple rapid tests that act as indicators of possible problems.
- c) Other basic parameters that should be regularly monitored include pH, conductivity, turbidity, colour and E. coli (or, alternatively, thermos tolerant coliforms) as in an ordinary community water supply.
- d) Routine sanitary inspection of a temporary water supply by the appropriate health authority is very important.
- e) If any problem related to water quality arises, remedial actions should be taken promptly.

# **CHAPTER 7**

## **SITE CLEARANCE**

## **Chapter 7 Site Clearance**

### **7.1 Introduction**

Clearing and excavation is part of the greater job which is carried out in preparing site for construction projects. This is the first task of site preparation. The site should be in a cleared and graded condition. It involves the removal of trees, demolishing buildings, removing any and all old underground infrastructure, and any other obstacles that might affect the construction process in the future or hinder the project to be done.

After designating the area to be cleared, the first step is to remove vegetation. This begins with undergrowth. After the undergrowth is cleared away, only large vegetation, such as trees and shrubs, is left to be cleared. Clearing the undergrowth first creates a safer, easier space to do the labor or tree removal. Tree cutting can be very dangerous and requires skill and expertise.

The trees are cut to leave tall stumps that are easier to remove. We remove the stumps using machinery, then focus on removing the roots. It's especially important to remove stumps and roots, as the decaying woody material can cause cracks in concrete structures built on the site. We also remove large stones and dig out animal burrows and fill them with clay. Vegetation within a surrounding designated workspace area should be cleared. Any trees and shrubs within at least 30 feet of the construction site should also be cleared.

### **7.2 Objective**

The objectives of this chapter are:

- a) Understand the importance of site clearing.
- b) Ensure the site is in condition of free of Existing obstruction such as natural unused or none schedule of contouring earth level and native growth plantation; dumping debris or waste on the projection schedule project site and to be demarcates from the open public usage.
- c) Plan a proper planning by provide for the measures necessary to protect the cleared area from erosion, protect other vegetation, and proper way of removal of the unwanted vegetation.

### 7.3 Definition

- a) **Site** - an area of ground on which a town, building, or monument is constructed
- b) **Site clearance** - an important part of many construction and demolition projects. It involves removing machinery and hazardous substances from a site, as well as levelling and preparing land for any planned construction or landscaping.
- c) **Hoarding** - A temporary board fence erected round a building site.
- d) **Drainage** - A system of drains. To prevent flooding on site.
- e) **Incineration Pound** - to incinerate the slit water before discharging to the monsoon drain. To prevent the water pollution in the public.
- f) **Grubbing** – denotes the removal of trees, shrubs, stumps, and rubbish from a site, often from the site on which a transportation or utility corridor, e. g. a road or power line; an edifice, e. g. a home or office; or a garden is to be constructed. Grubbing is performed following clearance of trees to their stumps and preceding construction.
- g) **Topsoil** – the upper, outermost layer of soil, usually the top 2 inches (5.1 cm) to 8 inches (20 cm). It has the highest concentration of organic matter and microorganisms and is where most of the Earth's biological soil activity occurs.
- h) **Filling** – the process of constructing a railway, road or canal whereby the amount of material from cuts roughly matches the amount of fill needed to make nearby embankments, so minimizing the amount of construction labour.
- i) **Compaction** - the process in which a stress applied to a soil causes densification as air is displaced from the pores between the soil grains. When stress is applied that causes densification due to water (or other liquid) being displaced from between the soil grains, then consolidation, not compaction, has occurred. Normally, compaction is the result of heavy machinery compressing the soil, but it can also occur due to the passage of (e.g.) animal feet.
- j) **Borrow** – excavation from outside the construction batter limits shown on the drawings.

## 7.4 Legal Requirement

Factory and Machinery Act 139:

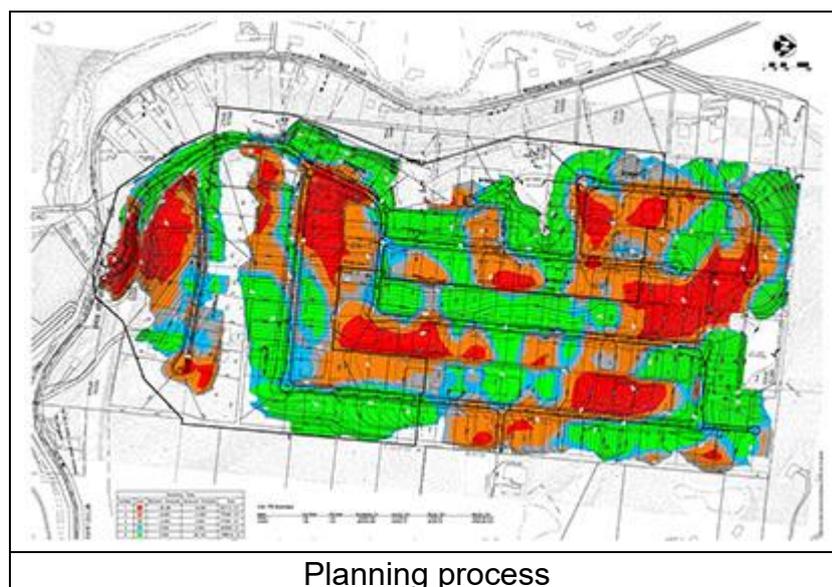
- a) Building Operations and Works of Engineering Construction Regulation 1986
  - i. Regulation 10 : Access of the work place
  - ii. Regulation 17 : Power driven saw
  - iii. Regulation 18 : Public vehicular traffic
  - iv. Regulation 22 : Disposal of debris
  - v. Part XII : Excavation work
  - vi. Part XIII : Material handling and storage, use and disposal
  - vii. Part XVI : Hand and power tools
  
- b) Noise Exposure Regulation 2019

## 7.5 Procedure

### 7.5.1 Planning

The planning should include:

- a) Do not begin land clearing activities until the site has been assessed, and the trees which have been selected for cutting have been tagged.
- b) Clear large-scale sites in phases to allow second-phase work to proceed in the initially cleared area, while clearing proceeds in other areas on the site.
- c) A map of the parcel showing areas previously cleared, proposed area or areas of clearing, area of stacking removed vegetation, dumping area and traffic management control (**refer to Chapter 5 Roadwork and Traffic Management**).
- d) Install all required erosion and sediment control devices.
- e) Review soil borings and other geotechnical information.
- f) Observe existing drainage patterns.
- g) Plan access and excavation patterns.
- h) Determine handling of spoils.
- i) Verify original ground surfaces (compare against existing contours or cross sections shown on the plan).
- j) Where the site is located in the immediate vicinity of the build-up area, hoarding should be erected with proper and adequate signage to prevent unauthorized entry.



- k) All arrangement should be made to prevent landslides, sinkhole and flooding or other unstable ground condition. These arrangements should be confirming to the requirement of relevant authorities.
- l) Verify location of underground utilities through “Miss Utility” or local “one-call” system – check for utilities not included in one-call system – dig test pits to confirm actual locations
- m) Note location of aerial utilities for equipment and truck clearances
- n) Confirm that all applicable permits and approvals have been secured.
- o) The use of heavy machinery and control.

### 7.5.2 Cutting and Grubbing

Before starting grading operations, it is necessary to prepare the work area by removing all trees, brush, buildings, and other objectionable material and obstructions that may interfere with the construction of the roadway.

- a) Trees and brush should cut off close to the original ground surface so that the initial layers of fill can be placed and compacted properly.
- b) Unless otherwise specified, remove all vegetation, logs, stumps, boulders, roots, scrub, debris and dumped material and items within the limits of clearing.
- c) The felling trees should be done by trained personnel to ensure the safeguards of the public and prevent damaging of public property.
- d) Demolish and dispose of any minor man-made structures (such as fences and livestock yards), all rubbish and other materials that are unsuitable for use in the construction.
- e) The clearance will base on the site boundary to execute the clearance work.
- f) Natural feature should be left undisturbed where possible.

- g) Grass and topsoil shall not be removed as part of this initial clearing.
- h) In advance of clearing and grubbing operations, effective erosion and sedimentation control measures shall be implemented.
- i) All trees and stumps, on or within the limits of clearing, unable to be felled and removed by the clearing methods used by the Contractor shall be removed by grubbing.
- j) Grub out stumps and roots over 75mm diameter to a minimum depth of 0.5m below the natural surface or 1.5m below the finished surface level, whichever is the lower.
- k) Backfill grub holes with suitable spoil from excavations compacted in layers to the density of the surrounding undisturbed soil.
- l) The Contractor shall take all measures to prevent damage to existing underground and overhead utility services.
- m) Every precaution shall be taken to prevent timber from falling on private property and the Contractor shall dispose of any timber so fallen or produce the written consent of the owner to its remaining there. The cost of disposal of such fallen timber shall be borne by the Contractor.



- n) Vehicles and plant shall not be parked under existing tree canopies. Refuelling and storage of chemicals and fuel shall not be permitted beneath existing tree canopies.
- o) Work within 3metres of trees to be protected shall be carried out by hand to avoid damage by equipment. Cut roots neatly in the line of the work before commencing machine excavation.
- p) If any tree is damaged during the course of the work, the Superintendent may direct the Contractor to effect repairs or remove and replace the tree.

### 7.5.3 Disposal of Material and Vegetation

Unless otherwise specified, all materials cleared and grubbed in accordance with this Specification shall become the property of the Contractor and shall be removed from the site and legally disposed of.

- a) Disposal of timber and other combustible materials by burning shall not be permitted.
- b) Where permitted, the Contractor shall comply with all Statutory requirements applicable to burning off, and any such burning off shall be carried out in such a manner that no damage is done to any trees outside the limits of clearing.
- c) Smoke resulting from such burning off shall not cause a traffic hazard or a nuisance to adjacent landholders.
- d) Where possible, reduce the volume of stumps, roots, logs, brush, limbs, tops, and other debris resulting from clearing or thinning operations, by processing the material with a chipping machine.
- e) The wood-chip mulch shall be produced from branches having a maximum diameter of 100 millimetres and the chipped material produced shall not have two orthogonal dimensions exceeding 75mm and 50mm.



Wood chipping process

### **7.5.4 Excavation (Refer to Chapter 9 Excavation Work)**

Because of the top soil at the surface of the earth cuts is usually unsuitable for use in compacted earth fills, it is normally stockpiled for later use in landscaping the project. The limit and depth of topsoil removal, where specified are usually included in the plans.

#### **a) General**

- i. Excavate to conform to the lines, grades, cross sections and dimensions shown on the drawings.
- ii. The Superintendent may order the removal of any soft spots, debris or organic material exposed when excavated areas have been trimmed to finished formation levels.
- iii. Remove all rocks and boulders which protrude above finished surfaces of subgrades.
- iv. Separate the best granular materials from excavations for use in the upper layers or fill subgrades.



Excavation work

## **b) Stripping and Stockpiling of Topsoil**

Prior to the commencement of earthworks topsoil is to be stripped within the limits of the earthworks. In particular topsoil is to be stripped from any areas to be covered by paving, structures or fill. Also strip topsoil within the limits of clearing for underground services beyond the limit of earthworks. Unless otherwise directed, the depth of stripping shall be to the bottom of the grassroots zone.

- i. Grass shall be stripped together with topsoil.
- ii. Avoid contamination by any other material.
- iii. Unless otherwise specified soils shall not be stripped from around existing trees closer than a distance equal to twice the radius of the trees crown measured from the trunk.
- iv. Temporary erosion and sedimentation control measures shall be taken in accordance with specified requirements.
- v. Topsoil stockpiles shall not exceed 2.5m in height and the maximum batter slope shall not exceed 2:1.
- vi. If to remain unused for more than four (4) weeks, topsoil stockpiles shall be sown as specified for "Temporary Grassing".

### **7.5.5 Filling**

Place and compact filling to conform to the lines, grades, cross-sections and dimensions shown on the drawings. Allow for the thickness of materials which will be placed in subsequent operations.

- a) Before filling commences the Contractor shall make available for inspection, by the Superintendent, the foundation of the embankment.
- b) The Superintendent may order the removal of any soft spots, debris, organic material, or other unsuitable material exposed when the nominal depth of topsoil has been stripped.
- c) This additional stripping may extend to a depth of 300mm below the general depth of stripping.
- d) Foundations of shallow embankments which are of a depth less than 1.0 metre from the top of pavement to natural surface shall be inspected and tested to determine if the material meets road subgrade requirements.
- e) Material used in the top 150mm below subgrades shall be free of particles larger than 75mm, material used in the top 600mm below subgrades shall be free of particles larger than 150mm and material used in the top 1 m below subgrades

shall be free of particles larger than 300mm. Elsewhere rock material shall be broken down to less than 600mm unless otherwise permitted.

- f) Rock material shall be broken down and evenly distributed through the fill material, and sufficient fine material shall be placed around the larger material as it is deposited to fill the voids and produce a dense, compact embankment.

#### **7.5.6 Borrow**

Borrow pits will not be permitted on site unless prior written approval is obtained from the Superintendent. In seeking such approval the Contractor shall provide adequate information on the proposed borrow pits including size, location and reinstatement.

The Superintendent may approve the winning of additional material on site by:

- a) uniform widening of cuttings
- b) uniform flattening of cut batters
- c) uniform grading of selected areas within the site

Where material is obtained from borrow pits the pit area shall first be cleared and stripped of topsoil. On completion of the operations, grade the pit to remove abrupt changes of slope or level, respreads topsoil and grass as specified for "Dryland Grassing". Provide drainage and erosion protection as necessary. Pits shall be free draining.

#### **7.5.7 Compaction**

Place and compact filling in uniform layers of thickness appropriate to the nature of material and the compaction equipment being used. Layers shall extend for the full width of embankments and shall be placed such that they are parallel to the finished surface.

- a) In earth fills the maximum layer thickness generally shall be 150mm compacted. However, greater thicknesses will be permitted subject to the ability of compaction equipment to achieve specified densities.
- b) No layer shall be less than 100mm thick compacted. Each layer shall be compacted to the appropriate density.
- c) Water spraying equipment used for this purpose shall be capable of distributing water uniformly in controlled quantities over uniform lane widths.
- d) Where clay is used as filling it shall be taken directly from the excavation to the fill site, placed and compacted without delay to prevent drying beyond the specified limit.



Compaction of soil

### **7.5.8 Miscellaneous**

- a) Site drainage to be comply to prevent flooding on site could cause damaging site working access. Incineration pound to incinerate silt water before discharging to the public.
- b) Access and egress shall have maintained in condition.
- c) Wash trough shall be construct to prevent dust and mud dirt generated by verticals
- d) Existing underground services and overhead utilities shall be taken proper caution caring to avoid undue accident.
- e) All personnel entry shall be register and safety briefing shall be conducted.
- f) All task shall be applying PTW (permit to work) before execute.

# **CHAPTER 8**

# **PILING WORK**

## Chapter 8 Piling Work

### 8.1 Introduction

Pile foundations are used extensively for the support of buildings, bridges, and other structures to safely transfer structural loads to the ground and to avoid excess settlement or lateral movement. They are very effective in transferring structural loads through weak or compressible soil layers into the more competent soils and rocks below. A "driven pile foundation" is a specific type of pile foundation where structural elements are driven into the ground using a large hammer. They are commonly constructed of timber, precast prestressed concrete (PPC), and steel (H-sections and pipes)

### 8.2 Objective

The objectives of this chapter are:

- a) Understand the purpose of foundation piling.
- b) To ensure the piling work is executed in the proper and safety manner.
- c) To schedule and plan a proper task manner to prevent and eliminate hazards before danger occurrence or accident happen.

### 8.3 Definition

- a) **Anvil** - The part of a power-operated hammer, which receives the blow of the ram and transmits it to the pile.
- b) **Batter pile** - A pile driven at an angle to the vertical.
- c) **Bearing pile** - A pile driven or formed in the ground for transmitting the weight of a structure to the soil by the resistance developed at the pile point or base and by friction along its sides.
- d) **Cast-in-place pile** - A pile formed by excavating or drilling a hole and filling it with concrete.
- e) **Concrete piles** - Piles made of concrete aggregate either cast-in-place or precast.
- f) **Drop hammer** - A weight with grooves in the sides that falls on the end of the pile when driving.
- g) **Heaving** - Uplifting of earth, between or near piles, caused by pile driving. Also, uplifting of driven piles in such a mass of earth.
- h) **Jetting** - A method of forcing water around and under a pile to loosen and displace the surrounding soil.
- i) **Moon beam** - A slightly curved beam placed transversely at the forward end of the pile driver to regulate side batter.
- j) **Soil profile** - A graphic representation of a vertical cross section of the soil layers below ground surface.

- k) **Pile** - is a type of deep foundation, used to transfer the load to a deeper level than is possible with a traditional shallow foundation. Vertical columns of concrete, steel or wood, or a combination, are driven deep into the ground to give extra support to the building that sits on top
- l) **Pile shoe** - an iron casting shaped to a point and fitted to a lower end of a wooden or concrete pile. Also called: shoe
- m) **Pile Cap** - is a thick concrete mat that rests on concrete or timber piles that have been driven into soft or unstable ground to provide a suitable stable foundation. It usually forms part of the foundation of a building, typically a multi-story building, structure or support base for heavy equipment.
- n) **Pitching** - to set firmly; implant; embed.
- o) **Driving** - is to insert the pile by the force of piling rig machine or plant.
- p) **Driving equipment** - a pile driver, is a device used to drive piles (poles) into soil to provide foundation support for buildings or other structures.
- q) **S.O. (superintendent officer)** - Job Under administrative supervision from a designated administrative officer, to plan, coordinate, and supervise new construction and remodelling of existing buildings.
- r) **Spotter** - A horizontal member connecting the base of fixed leads to the base of the crane boom. The spotter can be extended or retracted to permit driving piles on a batter and also to plumb the leads over the location of a vertical pile.
- s) **Test pile** - A pile driven to determine driving conditions and required lengths. Also a loading test may be made to determine the load-settlement characteristics of the pile and surrounding soil.
- t) **Ultimate bearing capacity** - The maximum load which a single pile will support. The load at which the soil cannot be penetrated.

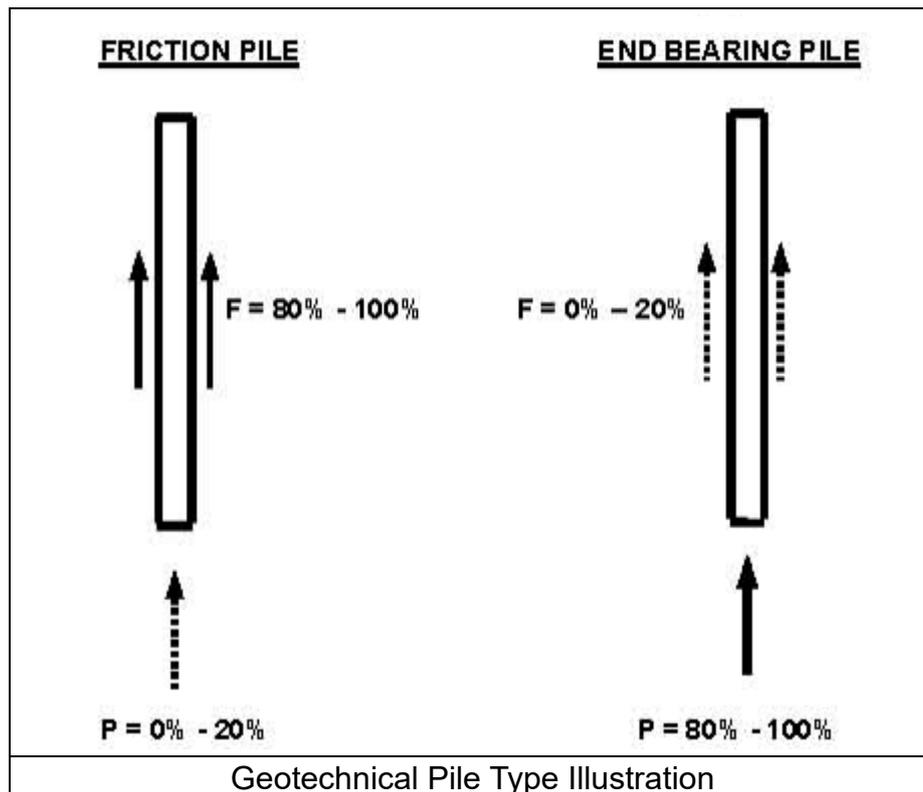
#### 8.4 Legal Requirement

- Factories and Machineries Act 1967 (Act 139)
  
- a) Building Operation and Works of Engineering Construction (Safety) Regulation 1986.
  - i. Regulation 124 :Stability of adjacent structure
  - ii. Regulation 125 :Inspection
  - iii. Regulation 126 :Protection of operators
  - iv. Regulation 127 :Qualification of operators
  - v. Regulation 128 :Handling of piles
  - vi. Regulation 129 :Pile driver not in used
  - vii. Regulation 130 :Ladders
  - viii. Regulation 131 :Working Platforms
  - ix. Regulation 132 :Pile
  - x. Regulation 133 :Pile testing
  - xi. Regulation 134 :Footing

## 8.5 Type

### 8.5.1 Geotechnical Pile Types

Geotechnical pile types consist of friction piles and end bearing piles. Friction piles derive their bearing capacity primarily from skin friction between the sides of the pile and the adjacent soil. Such piles are often referred to as displacement piles as they tend to displace soil to the sides of the pile during driving thereby consolidating the soil around the pile and increasing the skin friction. End bearing piles derive their bearing capacity primarily from soil or rock below the tip of the pile.



## 8.5.2 Structural Pile Types

	
H-Piles: Friction or End Bearing Piles	Metal Shell Piles: Friction Piles
	
Concrete Piles: Friction Piles	Timber Piles: Friction Piles

The pile tip must be fitted with pile shoes prior to driving. Pile shoes are considered reinforcement for the pile tip and are intended to try and prevent damage to the pile during driving. The need for pile shoes is assessed during design and indicated on the plans when dense soil layers or “hard driving” conditions are anticipated or when H-piles are being driven to hard rock such as dolomite or sandstone. If required, pile shoe details for H-piles and metal shell piles will be indicated in the plans.

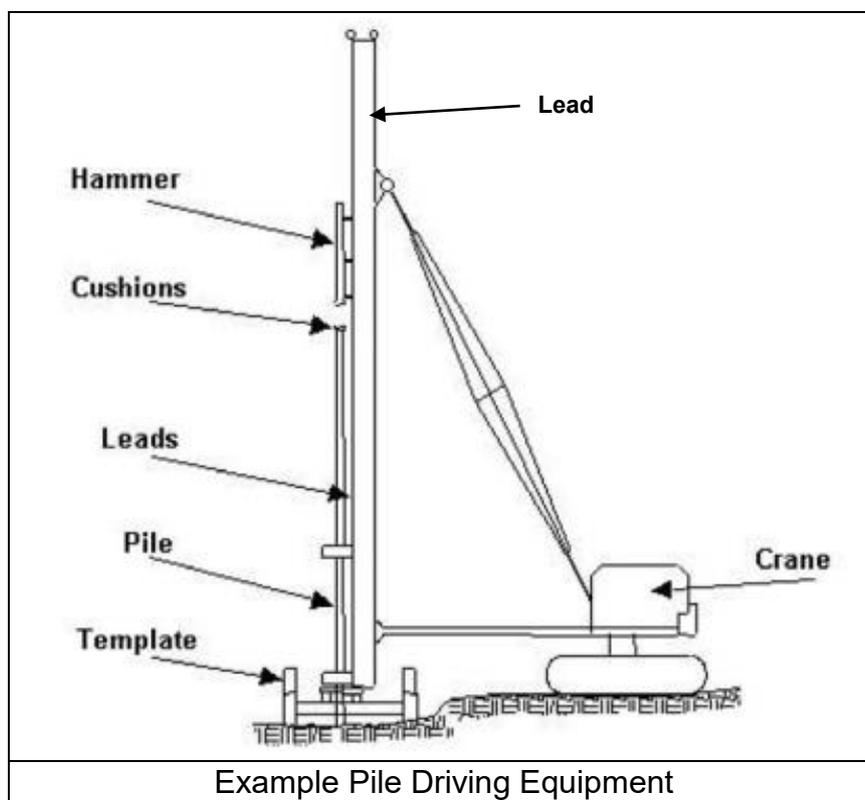
## 8.6 Procedure

### 8.6.1 Planning and mobilization.

- a) Piling work shall be commence after the site clearance has being done with the designate route access on site.
- b) Schedule proper laydown area for the mobilization of the R.C pile or spun pile. To prevent obstruction in the on the site internal route access. All mobilization.
- c) Demarcate the activities area with barricade and signages only for authorise personnel to entrance.

### 8.6.2 Pitching and Driving

- a) Pile shall pitch accurately and driven to the lines and level as shown on the drawing. During and after completion of piling, the pile head shall not be more than 75mm off centre in any one direction from its required position. Piles deflected from vertical with an eccentricity larger than this shall, where by S.O. be extracted or re-pitched until the proper line is obtained. No forcible method correction will be permitted. The Re-driving and modification foundation shall be borne by contractors if opinion of the S.O.
- b) During driving, the contractor must ensure that the piles head are properly protected.



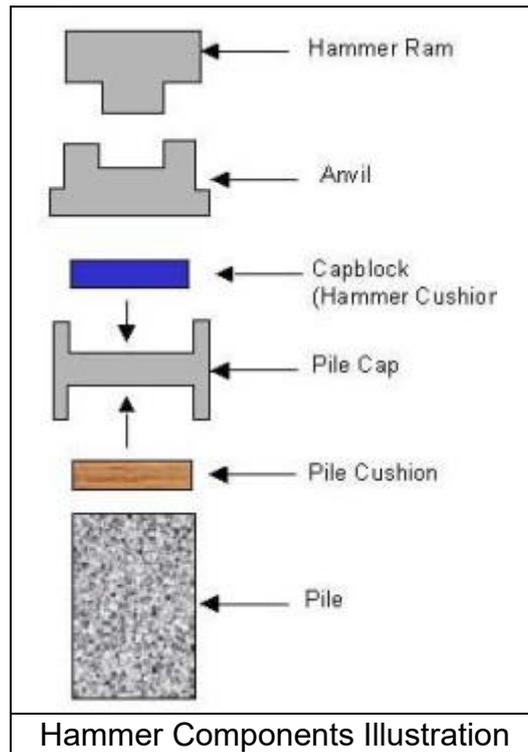
- c) The head of pile shall at all times be central with the hammer and normal to the length of the pile and the pile shall not run of position relative to the leaders.
- d) Where cracks or fissures appear in pile while is being, the pile shall be rejected
- e) All the above mention shall be handling with competent person. Stand on supervision shall require to ensure all activities and sequence to be proceed in proper and safety manner.

### **8.6.3 Pile Driving Plant**

- a) The weight of the hammer, height of drop and set be achieved shall be approved by the S.O. in general, for the heavy piles the weight of the hammer shall be least equal to the weight of the pile for hard driving conditions and not less than half of the weight of the pile for easy driving.
- b) The plant for the pile driving shall be type of such type and capacity with the approval of S.O.
- c) Beware of falling objects and take the necessary precautions to ensure that items are secured against wind and accidental displacement.
- d) Prior to being driven into the ground, piles can be long, slender and flexible members are difficult to handle and subject to buckling.
- e) Ensure that all rigging appliances for handling and driving piling is of sufficient capacity and suitable condition for the intended use. Do not use rigging that is worn & frayed.
- f) Do not climb on or lean against the leads that are not properly secured. To conduct any works related to the lean the item must be lower down by mechanical to the ground.

### **8.6.4 Extension of Pile.**

- a) As the result of measurement of the driving resistance or load bearing capacity of piles driven, P.E. may order the length of the pile to be modified either by lengthening in situ or by providing a longer initial length of pile.
- b) Where piles have to be further extended with extension piles, they shall be brought up to the required length by addition of an extension pile as shown on the drawing. The extension pile shall be placed in alignment and jointed as shown on the drawing.
- c) The pile head plate shall butt joint with end cap in full weld on the four side of the both metal cap to ensure the joint is consistent.



### 8.6.5 Pile Setting

- a) The final set shall be recorded either as the penetration in millimetres per 10 blows or as number of blows required to produce a penetration of 25mm. as suggested by the S.O.
- b) When a final set is being measured, the following requirement shall be met:
  - i. The exposed part of the pile shall be in good condition, without damage or distortion.



Damaged H-pile



Damaged Metal Shell Pile

- ii. The dolly and packing shall be in sound condition;
- iii. The hammer below shall be line with the pile axis and the impact surfaces shall be flat at right angle to the pile and the hammer axis.
- iv. The hammer shall be in good condition and operating correctly;
- v. The temporary compression of the pile shall be recorded.

### **8.6.6 Pile Cutting and Stripping Pile Head**

- a) When pile has been driven to the required set of depth and after load test has been carried out, the head of the pile shall be cut off to the level specified or shown in the drawings. The length of the reinforcing bars above shall be as shown or specified in the drawing.



Example of Unacceptable Notches Cut into Piles

- b) When piles are cut nearly flush with the ground, the heads should be covered to keep foreign material out from and to prevent someone from stepping into the pile.
- c) When flammable gases are encountered, drop a piece of lighted oil-soaked rag into the pile before cutting with a torch – keeping head and body away from the head of the pile.
- d) Designated person related to the piling activities must confirm all working procedure must be followed comply with the standard requirement practice.

## **8.7 Pile Driving Safety**

### **8.7.1 Site Conditions**

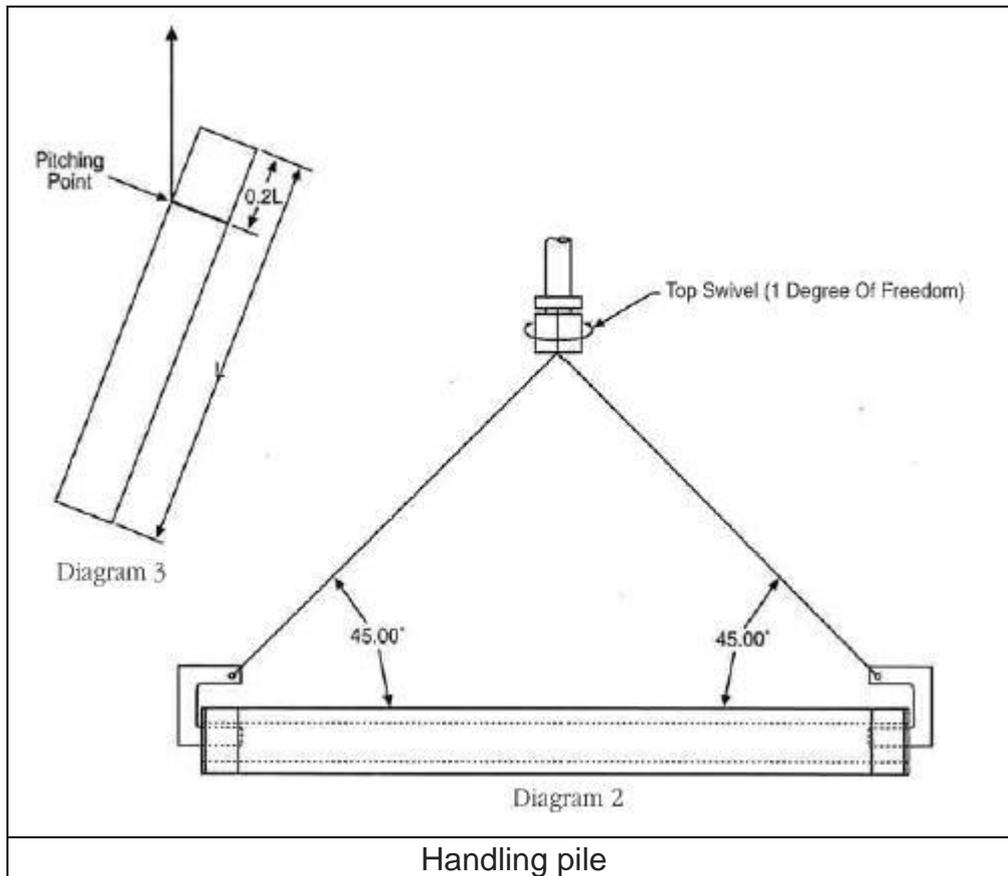
- a) Work areas and walkways need to be kept free of loose materials, debris, pile cut-offs, and scrap lumber. Platforms and walkways more than four feet off the ground, or in a hazardous location, should feature a secure handrail with a toe board.
- b) Properly built ladders must be maintained, with side rails extending 36" above a landing.
- c) Containers for oil rags, combustible materials, and trash should be provided, with unused equipment stored outside of the working area.
- d) When possible, drain any muddy area onsite and provide plank runways across trenches if necessary. Slippery walkways and other areas should be sanded. Construction areas must be adequately lit if night work is to occur. Typically, temporary lights are installed, with power supplied by heavy-duty electric cords.
- e) When working in areas containing harmful gases, vapours, fumes, or inadequate ventilation, suitable precautions must be taken. Additionally, special care must be taken when working in potentially flammable environments.

### **8.7.2 Material Storage**

- a) Stowed materials should be blocked, stacked, or secured in varying fashions to prevent sliding, falling, or collapse. If possible, stored materials should not be stacked higher than five feet. When storing materials on platforms or in buildings, do not exceed safe floor-loading specifications.
- b) Bore pile casing should be stored using stakes or chocks, to prevent spreading, and placed away from the edge of any embankment.

### **8.7.3 Material Handling**

- a) When unloading shells and other pile material from a truck, make sure the load is safely held while stakes are removed. Following stake removal, load binders should be released from the backside of the load.
- b) Handling large timbers, length woodpiles, and H-piles should be done using lifting appliances (i.e. chain sling, webbing sling, spreader etc)
- c) When handling materials, all workers should stand clear, with loads never being swung above the heads of those onsite. Tag lines should be utilized to control loads. No workers shall be permitted to ride on crane hooks, on top of loads, or in a truck's cargo section.



#### 8.7.4 Rope

- a) Because ropes are easily cut or abraded, frequent inspection for wear and tear is necessary. A rope's tail ends should never be cut off; rather, they should be tucked in beyond the splice.
- b) During operations, workers should be advised to never stand alongside any rope under heavy strain, and especially nylon rope, which is stretchy and can be hazardous if a load is suddenly released.
- c) Wire rope should be discarded when significant wear from outside wires, kinks, bird cages, corrosion, and crushing or heat damage is noted. A wire rope broken while in service should be replaced and never spliced.
- d) Running ropes should be trashed when six randomly distributed broken wires or three broken wires in one strand can be found. Standing ropes must be replaced when more than one broken wire is present at an end connection, or when more than two broken wires are identified elsewhere.
- e) Manila rope eye splices should have a minimum of three full tucks, with synthetic rope eye splices featuring four full tucks.

### **8.7.5 Slings, Chains, Hooks, Shoring**

- a) Loads should always be picked up with slings and never wrapped with a hoist line. Such slings must be inspected before each use, with workers discarding any sling featuring six or more closely spaced broken wires. Keep slings clean and lubricated to prevent rusting and to extend their useful life. When handling mats, utilize a two-leg sling.
- b) All chains utilized should be of alloy steel grade, and paired with links, hooks, and rings to obtain full strength. As with ropes, chains should be inspected regularly and replaced when showing obvious wear. A wear of 1/8" at any point on a standard 5/8" pile chain is reason for disposal. All chains should be permanently affixed with a tag that states their size, grade, rated capacity, and manufacturer.
- c) Used only for temporary connections, hooks must be closely observed and never used for drills, jets, siphons, or other semi-permanent attachments. Instead, shackles are preferred in such cases.
- d) Hooks should be turned so the pull of the line or chain is always into the hook. If a load could be momentarily slacked, a safety hook should be used. Any hooks showing cracks or signs of straightening must be disposed of.
- e) Shoring must be installed from the top down and removed in the opposite fashion. Hydraulic shoring should be inspected at least once per shift for leaking hoses or cylinders, broken connections, cracked nipples, bent bases, or any additional damage.

### **8.7.6 Moving the Rig**

- a) Operating over unstable ground represents the most hazardous aspect of moving the rig. As a rule, avoid moving a rig over areas where the ground is soft or uncompact. Areas above old sewers or underground structures that will not support the rig, or areas adjacent to excavations, should also be avoided when possible. If crossing over an old sewer or freshly backfilled trench, double matting represents the simplest precaution.



Moving rig on stable floor

- b) Working near the edge of an excavation is typically avoided, as the edge of cats should be kept at least two feet back from the toe of excavation for each foot of height. When working near the edge of an excavation is necessary, the slope should be sheeted and braced, or the mats supported by stacks of mats, cribbing, posts, or false-work piles.
- c) If operating the rig above a deep excavation, cribbing may be utilized for support. These cribs should be founded on planking. If the excavation is six or more feet deep, a steel beam trestle should span the hole rather than one of plank wood. The rig can also be mounted on a gantry.
- d) Clearing overhead obstacles is vital to rig movement, with leaders not to come within 20 feet horizontally or 10 feet vertically of high-tension lines. When overhead obstructions can't be avoided, the rig may be dismantled.
- e) If a rig travels on ramps, significant coordination between the supervisor and operator is necessary, as this operation is fundamentally hazardous.
- f) Before entering on a ramp, locks should be checked, and with the operator prepared to engage them quickly. The travel lock should be in ratchet position when going uphill, with the leaders facing uphill and the boom down if necessary. Additionally, the operator should hold the hammer on the brake so that it can be lowered to the ground to serve as an anchor.
- g) If it is necessary to drive piles from a ramp, wedges can be cut from heavy timbers to fit under each track. This will temporarily level the rig for driving.

- h) When moving the rig around the site, the supervisor should position himself in the operator's view while also being able to view the operating areas to the rear and sides.
- i) Only the lifting supervisor, or a trained signaller, should signal to the operator, with standard hand signals. Additionally, the lifting supervisor and the signaller should ensure that all workers are clear before the mentioned operation commences.

### **8.7.7 Noise**

- a) To ensure all measures to control the noise levels produced by this operation on site should comply with the regulations, or by the working rules.
- b) Specifically, the operators may arrange in respect of all work done under these terms:
  - i. That all compressors used on the site are silenced either fully silenced model, fitted with effective exhaust silencer and properly lined and sealed acoustic cover, all to the designs of the manufacturers of the compressors
  - ii. The ancillary pneumatic percussive tools and other machinery used on the site are fitted with silencer of a type recommended by the manufacturer thereof.
  - iii. That every such compressor, silencer or other contrivance is maintained in good and efficient working order and shall not have been altered in such a way the noise caused in operation is made greater by the alteration.
- c) The employer responsibility for taking immediate steps to reduce such noise to the acceptable noise level.

### **8.7.8 Vibration**

- a) The type of pile and method of installation is to be such that any vibration, shock etc., caused does not damage any surrounding structures, services etc. or cause any legally actionable disturbance.
- b) All methods of working, cost, etc, necessary to avoid any nuisance, damage, etc., are deemed to have been included in the tender.

## **8.8 Miscellaneous**

- a) In view of the prevailing need to conserve the environment and protection of the public health, piling machinery that generate excessive vibration, noise, smoke, or other pollutant should not be used.
- b) Where there is any question of stability of structures adjoining areas to be piled such structure shall be supported where necessary by underpinning, sheet piling, shoring bracing or means in accordance with design of a P.E to prevent injury to any person. (reg 124, BOWEC (safety) regulations, 1986).
- c) All pile shall be inspected daily by a designated person before the start of work and every defect shall be immediately corrected before pile-driving commence. (reg 125, BOWEC (safety) regulations, 1986)
- d) Reasonably practice measure shall be taken to warn person not to approach within 50 metres of a pile under test. (reg 133(2), BOWEC (safety) regulations, 1986)
- e) Before placing or advancing a pile driver, the ground shall be inspected by a designated person and, where necessary for the firm and level footing, timber shall be placed. After placing or advancing a pile driver, inspection and correct of footing shall be made, when necessary, to maintain stability. (reg 134, BOWEC (safety) regulations, 1986)
- f) Required ear protection to the task worker to prevent high noise impact.
- g) Health hazards such as contact with contaminated risings or groundwater and contact with hazardous materials or dusts, noise, vibration must be considered.
- h) Proper monitoring upon the plant or machinery during lifting, slewing and pitching of piling elements, the movement of piling rigs etc.
- i) Plant instability caused by gradients, variable ground conditions, and/or inadequate bearing capacity, hazards of buried or overhead services, collapse of excavations and nearby structures etc. to be considered.

# **CHAPTER 9**

# **EXCAVATION WORK**

## Chapter 9 Excavation Work

### 9.1 Introduction

Excavation failures are particularly dangerous because they may occur quickly, limiting the ability of workers (and in some cases others in the vicinity) to escape especially if the collapse is extensive.

Excavation is the process of moving earth, rock or other materials with tools, equipment or explosives. It includes earthwork, trenching, wall shafts, tunneling and underground. Excavation has a number of important applications including exploration, environmental restoration, mining and construction.

Among these, construction is one of the most common applications for excavation. Excavation is used in construction to create building foundations, reservoirs and roads. Some of the different processes used in excavation include trenching, digging, and dredging and site development. Each of these processes requires unique techniques, tools and machinery to get the job done right. The processes used will depend upon the structure that will result from the construction process

### 9.2 Objective

The objectives of this chapter are:

- a) Understand the safety issue in the excavation work
- b) Ensure principal contractor to follow the Malaysian Law and regulation.
- c) Plan a proper planning before starting excavation work
- d) Ensure safe operation and taking care of the safety, health and welfare of the workers.

### 9.3 Definition

- a) **Barrier** - means a physical structure which blocks or impedes something. Barricade means any object or structure that creates a barrier obstacle to control, block passage or force the flow of traffic in the desired direction.
- b) **Backfill** - means material used for refilling excavations.
- c) **Battering** - means to form the face or side or wall of an excavation to an angle, usually less than the natural angle of repose, to prevent earth slippage.
- d) **Bench** - means a horizontal step cut into the face or side or wall of an excavation to provide horizontal bearing and sliding resistance.
- e) **Benching** - means the horizontal stepping of the face, side, or wall of an excavation.
- f) **Closed sheeting** - means a continuous frame with vertical or horizontal sheathing planks placed side by side to form a continuous retaining wall supported by other members of a support system used to hold up the face of an excavation.

- g) **Designated person** - means a person who appointed by employer that has acquired through training, qualification or experience the knowledge and skills to carry out the task.
- h) **Earthmoving machinery** - means operator controlled mobile plant used to excavate, load, transport, compact or spread earth, overburden, rubble, spoil, aggregate or similar material, but does not include a tractor or industrial lift truck.
- i) **Exclusion zone** - means an area from which all persons are excluded during excavation work.
- j) **Face** - means an exposed sloping or vertical surface resulting from the excavation of material.
- k) **Geotechnical Engineer** - means a professional engineer whose register under Section 10(2) of the Registration of Engineer Act 1967 (Revised 2015) and who has qualifications and experience in soil stability and mechanics and excavation work.
- l) **Hoist** - means an appliance intended for raising or lowering a load or people, and includes an elevating work platform, a mast climbing work platform, personnel and materials hoist, scaffolding hoist and serial hoist but does not include a lift or building maintenance equipment.
- m) **Overburden** - means the surface soil that must be moved away.
- n) **Operator protective device** - means a roll-over protective structure (ROPS), falling object protective structure (FOPS), operator restraining device and seat belt.
- o) **Powered mobile plant** - means plant that is provided with some form of self-propulsion that is ordinarily under the direct control of an operator.
- p) **Safe slope** - means the steepest slope at which an excavated face is stable against slips and slides, having regard to the qualities of the material in the face, the height of the face, the load above the face and the moisture conditions for the time being existing.
- q) **Shaft** - means a vertical or inclined way or opening from the surface downwards or from any underground working, the dimensions of which (apart from the perimeter) are less than its depth.
- r) **Sheet piling** - means vertical, close-spaced, or interlocking planks of steel, reinforced concrete or other structural material driven to form a continuous wall ahead of the excavation and supported either by tie-backs into solid ground structural members from within the excavation as the work proceeds.

## 9.4 Legal Requirement

a) Occupational Safety and Health Act 514:

- i. Section 15 : General duties of employers and self-employed person to their employees.
- ii. Section 24 : General duties of employees

Factory and Machinery Act 139:

b) Safety Health and Welfare Regulation 1970

- i. Regulation 7 : Access to place of work
- ii. Regulation 8 : Openings generally fence
- iii. Regulation 9 : Stairway
- iv. Regulation 19 : Object on inclines
- v. Regulation 20 : Stacking of materials
- vi. Regulation 32 : Working cloth, personal protective clothing

c) Building Operations and Work of Engineering Construction Regulation 1986

- i. Regulation 6 : Machinery installed on any floor above the ground floor
- ii. Regulation 8 : Slipping hazards
- iii. Regulation 9 : Tripping and cutting hazards
- iv. Regulation 10 : Access to workplace
- v. Regulation 11 : Dust and gases
- vi. Regulation 13 : Eye protection
- vii. Regulation 14 : Respirators
- viii. Regulation 15 : Protective apparel
- ix. Regulation 18 : Public vehicular traffic
- x. Regulation 19 : Stability of structure
- xi. Regulation 20 : Illumination of passageways
- xii. Regulation 21 : Storage of materials and equipment
- xiii. **Part XII : Excavation Work**

d) Noise Exposure Regulation 2019

e) Guidelines on Occupational Safety and Health in Construction Industry (Excavation Work) 2017

## **9.5 Procedure**

### **9.5.1 Responsibility**

#### **a) Employer**

Employer have primary duty to ensure, so far as is reasonably practicable, that workers and other persons are not exposed to health and safety risks arising from the business or undertaking.

The employer who undertaking excavation work must take all reasonable steps to obtain current underground essential services information relating to the part of a workplace where the excavation work is being carried out and areas adjacent to it before directing or allowing the excavation to commence. This information must be provided to any person engaged to carry out excavation work.

#### **b) Designers**

Designers of structures must ensure, so far as is reasonably practicable, that the structure is without risks to health and safety, when used for a purpose for which it was designed. Designers must give the person who commissioned the design a written safety report that specifies the hazards relating to the design of the structure

#### **c) Designated Person**

A designated person is an individual, designated by the employer, who is capable of identifying existing and foreseeable hazards in the surroundings or working conditions which are unsanitary, hazardous or dangerous to workers, and who is authorized to take prompt corrective measures to eliminate them.

#### **d) Safety and Health Officer**

Duty to exercise due diligence to ensure that excavation activity undertaking complies with the Occupational Safety and Health Act and Regulations.

#### **e) Workers**

Workers have a duty to take reasonable care for their own health and safety and that they do not adversely affect the health and safety of other persons. Workers must comply with any reasonable instruction and cooperate with any reasonable policy or procedure relating to health and safety at the workplace.

### **9.5.2 Planning**

Excavation work should be carefully planned before work starts so it can be carried out safely. Planning involves identifying the hazards, assessing the risks and determining appropriate control measures in consultation with all relevant persons involved in the work including the principal contractor, excavation contractor, designers and mobile plant operators. Structural or geotechnical engineers may also need to be consulted at this stage.

Consultation should include but not limited to:

- a) Nature and/or condition of the ground and/or working environment.
- b) Weather conditions.
- c) Nature of the work and other activities that may affect health and safety.
- d) Static and dynamic loads near the excavation.
- e) Interaction with other trades.
- f) Site access.
- g) Safe Work Procedure. „
- h) Management of surrounding vehicular traffic and ground vibration, type of equipment used for excavation work.
- i) Public safety.
- j) Existing services and their location.
- k) The length of time the excavation is to remain open.
- l) Provision of adequate facilities.
- m) Procedures to deal with emergencies.

### **9.5.3 Safe Work Procedure (SWP)**

If the excavation work is or involves high risk construction work, the employer must prepare a SWP before the high risk construction work starts.

The Safe Work Procedure include but not limited to:

- a) Identify the type of high risk construction work being done.
- b) Specify the health and safety hazards and risks arising from that work.
- c) Describe how the risks will be controlled.
- d) Describe how the control measures will be implemented, monitored and reviewed.
- e) Be developed in consultation with workers and their representatives who are carrying out the high risk construction work.

In some circumstances one SWP can be prepared to cover more than one high risk construction work activity being carried out at the workplace by contractors and/or subcontractors. For example, where there is:

- a) A risk of a person falling more than 2 metres
- b) A trench with an excavated depth greater than 1.5 metres.

In this case, the contractors or subcontractors can consult and cooperate to prepare one SWP. Alternatively they can prepare separate SWP. If they choose to do this they must consult with each other to ensure all SWP are consistent and they are not creating unintended additional risks at the workplace.

## 9.6 Controlling Excavation Risks

### 9.6.1 Excavation Safety

First try and eliminate the risks but if that is not reasonably practicable, then minimize them, so far as is reasonably practicable. A combination of controls may need to be used. Make sure controls prevent anyone being harmed, so far as is reasonably practicable. They must translate into practical standards and expectations, roles, responsibilities, and processes that are relevant for everyone in the supply chain.

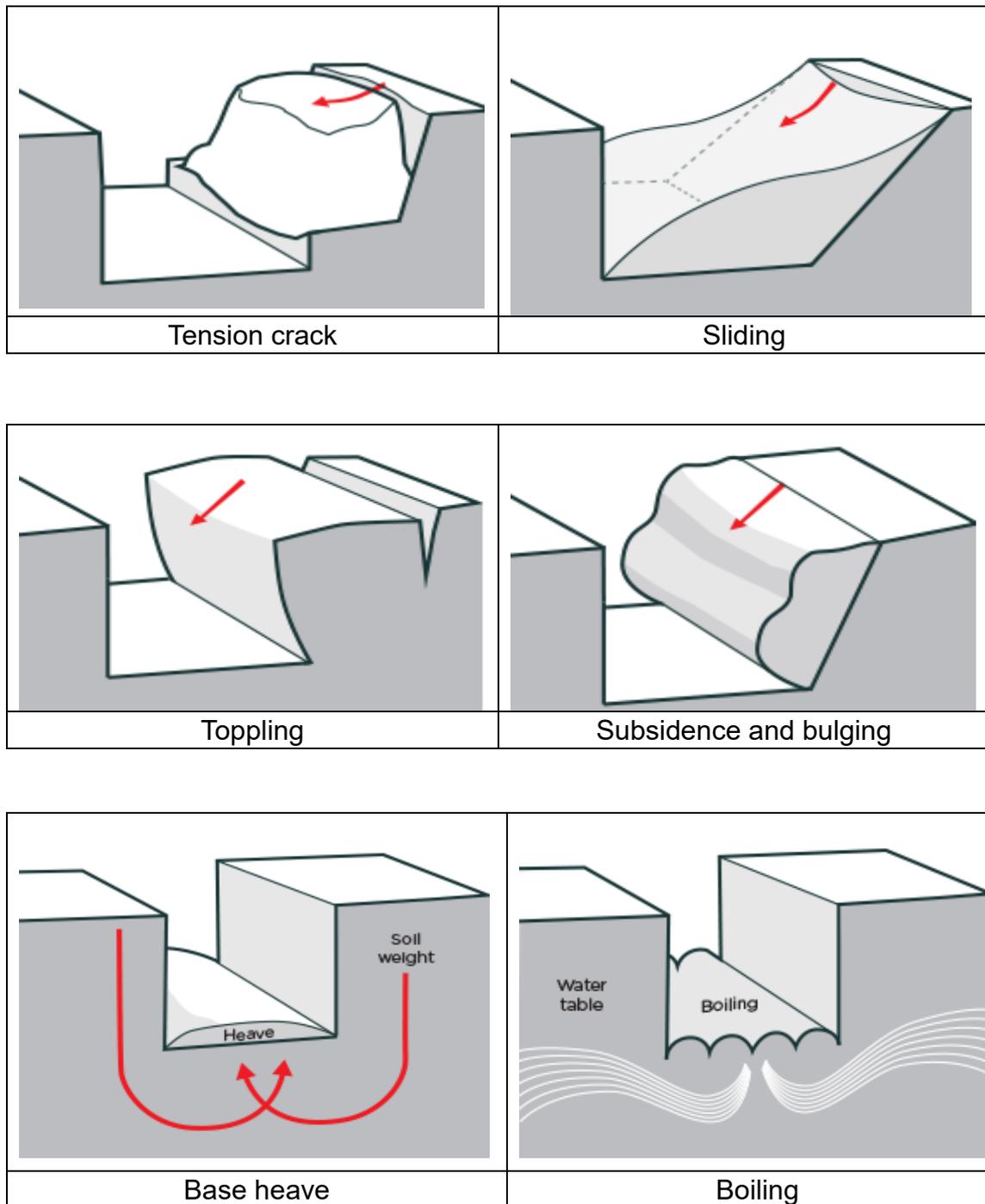
Consider	Example Control
<p><b>Excavation Hazard</b></p> <ul style="list-style-type: none"> <li>• Unstable placement of excavated materials, plant or other loads</li> <li>• Influence on any nearby structure</li> <li>• Previous disturbance of the ground</li> <li>• External actions causing instability</li> <li>• Presence of or possible inrush of water or other liquid</li> </ul>	<ul style="list-style-type: none"> <li>a) Identify safe and secure places for excavated materials, plant and other equipment</li> <li>b) Soil-input for stability and best method for support</li> <li>c) Processes for dewatering in place</li> <li>d) Assess hazardous substances and contaminated soil.</li> </ul>

<b>Falls and Falling Objects</b> <ul style="list-style-type: none"><li>• Unprotected excavated area</li><li>• Unstable placement</li></ul>	<ol style="list-style-type: none"><li>a) Edge protection with toe-board in place</li><li>b) Safe access and egress</li><li>c) Catch platform</li></ol>
<b>Hazardous atmosphere in an excavation</b>	<ol style="list-style-type: none"><li>a) Gas and fumes monitoring</li><li>b) Respirators – fitted and maintained correctly</li><li>c) Confine space requirement (<b>Refer Chapter 10: Sewage and Drainage</b>)</li></ol>
<b>Natural hazards and weather</b>	<ol style="list-style-type: none"><li>a) Geotechnical site assessment</li><li>b) Inspecting to find out what might affect the stability of the excavation (an excavation face can appear stable for 24 hours, but may be unstable)</li></ol>
<b>Overhead Services</b>	<ol style="list-style-type: none"><li>a) Identification and inclusion in safe system of work</li><li>b) Minimum approach distances for mobile plant and work activity from overhead lines</li><li>c) Minimum approach distances for excavation and earthworks from towers and support structures</li><li>d) Consents or permits</li><li>e) Applying required safety measures</li><li>f) SWP</li></ol>

<p><b>Underground services</b></p> <ul style="list-style-type: none"> <li>• Electricity, gas, sewerage, telecommunications, water, services</li> <li>• Chemicals, fuel or refrigerant in pipes or lines</li> </ul>	<ul style="list-style-type: none"> <li>a) Service plans from each service owner</li> <li>b) Trace and mark out services – detecting and marking actual layout</li> <li>c) Contingencies for excavations including emergencies</li> <li>d) Assume services are present until proven otherwise</li> <li>e) Divert or making if necessary</li> <li>f) Fit-for-purpose locating devices</li> <li>g) Consents and permits</li> <li>h) Exposing and identifying what and where services are</li> <li>i) Safe digging and excavation practice</li> <li>j) SWP</li> </ul>
<p><b>Site Safety</b></p> <ul style="list-style-type: none"> <li>• Insufficient natural lighting</li> </ul>	<ul style="list-style-type: none"> <li>a) Traffic management plan</li> <li>b) Site security</li> <li>c) Safety fencing and signage</li> <li>d) Provide suitable artificial lighting</li> </ul>
<p><b>Vibration and hazardous noise</b></p>	<ul style="list-style-type: none"> <li>a) Exclusion zones</li> <li>b) Noise and vibration reduction at source</li> <li>c) PPE</li> </ul>
<p><b>Manual Handling Task</b></p>	<ul style="list-style-type: none"> <li>a) Using lifting devices (e.g. hoist, cranes, trolleys)</li> <li>b) Manual handling training</li> </ul>
<p><b>Ground Stability and Removing Spoil</b></p>	<ul style="list-style-type: none"> <li>a) Stabilize the ground at the head of the shaft and remove spoil</li> <li>b) Continuously line or support the shaft</li> </ul>

**Table 1 Typical Excavation Hazards**

### 9.6.2 Type of Ground Collapse



### **9.6.3 Stability of an Excavation**

An excavated face's stability depends on the strength of the soil in the face being greater than any stresses. Some situations that increase soil stress in an excavated face and may lead to failure in bad weather, under extra load or vibration are:

- a) Deep cuts and steep slopes, by removing the natural side support of the excavated material
- b) Loads on the ground surface near the top of the face, such as excavated material, digging equipment or other construction plant and material
- c) Shock and vibration, caused by pile-driving, blasting, passing loads or vibration producing plant (e.g. compacting and drilling plant)
- d) Water pressure from groundwater flow, which fills cracks in the soil, increases horizontal stresses and may undermine the excavation
- e) Saturated soil increasing the soil's weight and sometimes the volume > natural hazards like floods or earthquakes (e.g. earthquakes can cause soil liquefaction).

Some conditions that may reduce soil strength are:

- a) Excess water pressure in sandy soil which may cause boiling and saturate the soil and increase its plasticity
- b) Soil dryness may reduce cohesion in sandy soil and soils with high organic content, which then crumble easily
- c) Prolonged stress, may cause plastic deformity (squeezing or flowing)
- d) Prolonged inactivity at an excavation site; reassess the soil before work begins.

### **9.6.4 Ground Investigation**

Weak, saturated, or otherwise unfavorable ground can have a significant effect on the construction and performance of an excavation. Consider having ground investigations and geotechnical assessments for excavations that are complex or may affect nearby structures or harm workers and others nearby. The ground investigation and geotechnical assessments should include:

- a) Advice on the suitability of different sites or distinct areas of a site for placing structures or services
- b) Suitable and economic design of both temporary and permanent works
- c) A method to identify and evaluate possible problems in constructing temporary and permanent works
- d) A process to reduce the risk of unforeseen ground conditions. This will decrease the need for changes in design and construction methods.

## **9.6.5 Prevent Ground Collapse**

If excavation work is planned without shoring, the continuing safety of the excavation will depend on the conditions arising during construction. If the conditions during construction are not as expected, or if conditions change during the course of the work (e.g. different soils, heavy rain/flooding) take immediate action to protect workers, other people and property.

Excavations shallower than 1.5 m have been known to collapse. If a worker is in the excavation and bending over or crouching down at the time of the collapse, he or she may suffer serious injury. Principal contractor must consider the risks associated with these excavations and determine if special precautions or work methods are necessary, for example shoring.

### **9.6.5.1 Managing Risk of Collapsing**

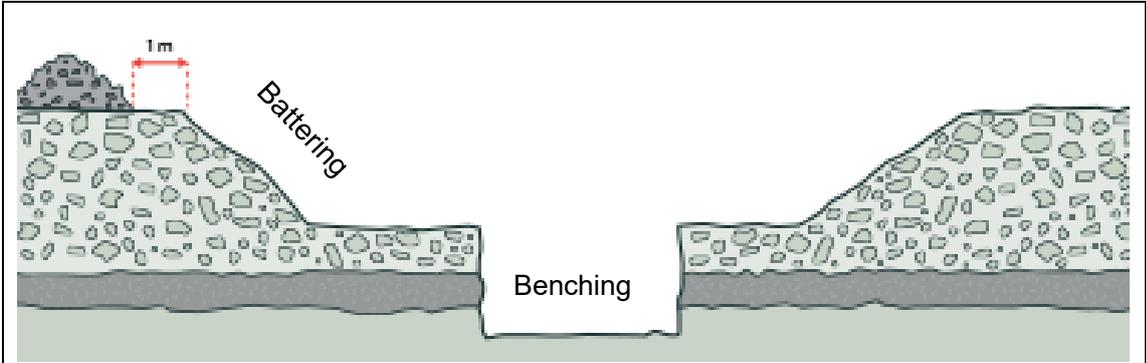
There are three main types of controls to prevent ground collapse. Make sure to use one or more of the following controls to support all sides of the excavation:

- a) **Benching** and battering stepping or sloping of the face, side, or wall of an excavation.
- b) **Shoring** prevents collapse by maintaining positive pressure on the sides of the excavation, protecting workers.
- c) **Shields** do not ensure stability but protect workers from ground collapse, by preventing the collapsing material falling onto them.

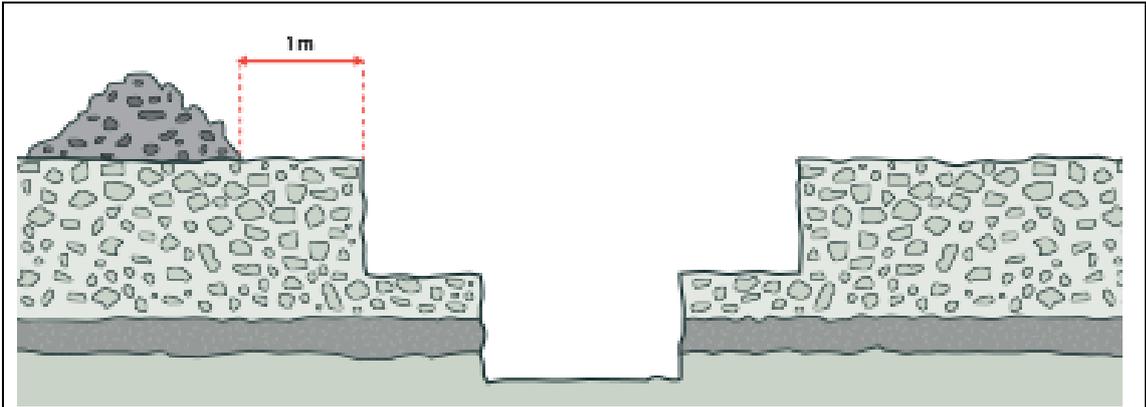
No matter how deep an excavation is, if there is a risk of collapse, put controls in place to prevent this. Involve a competent person when selecting what ground collapse controls to apply.

9.6.6 Shoring

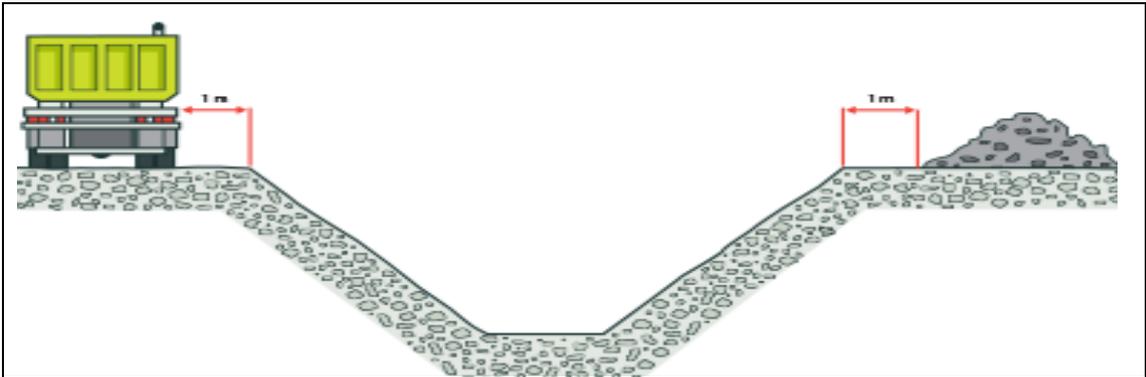
Shoring provides support to excavated faces to prevent soil moving and ground collapsing. If the ground is not self-supporting, and benching or battering is not suitable, use shoring to manage the risk of a person being buried or trapped during excavation work.



Combination of benching and battering controls



Benching control



Battering controls

When choosing shoring as a control use certified proprietary or non-proprietary systems, within their rated load capacity limits according to manufacturer or supplier instructions.

Research regarding the soil structure and soil parameter must be done before designing the shoring, battering and benching. Control measure is done by Geotechnical Engineer (PE) to ensure the type of soil, the humidity of the soil, the height of the excavation and the extra load on the surface of excavation area is taking into account before the activity.

**When doing the battering or benching, the resting gradient must not exceed 45° unless there are approval from the PE.** Slight increase of the water content in soil will affect the soil strength integrity exponentially. Frequent supervision and inspection must be done to ensure the soil integrity is intact.

The gradient for the battering prepared in the table below must carefully use as the nature of the soil are different and sometimes a combination of two or more type of soil.

Type of Soil	Dry Soil (Gradient°)	Wet Soil(Gradient°)
Gravel soil	30 – 40	10 – 30
Sandy soil	30 – 35	10 – 30
Silt Soil	20 – 40	5 – 20
Clay	20 – 45	10 – 35
Peat Soil	10 – 45	5 – 35

**Table 1 Typical safe gradient for battering in Malaysia**

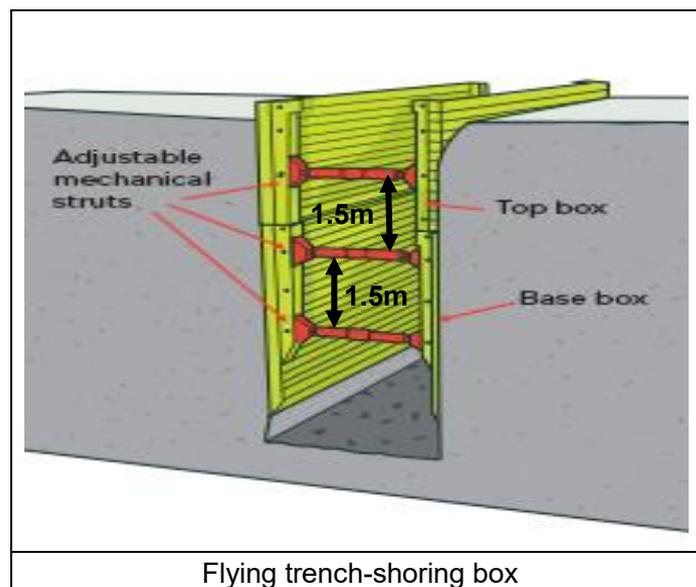
### 9.6.6.1 Flying Shoring

When using shoring, it may be possible to excavate below the base of the shoring, that is: 'flying shoring'. To do this, excavate to a minimum depth of 600 mm below the base of the shoring, if:

- a) The shoring is designed to resist the forces calculated for the full depth of the excavation, and
- b) There are no indications, while the excavation is open, of instability below the bottom of the shoring.

Control the risk of ground collapse and carefully visually inspect for any effects of:

- a) Bulging
- b) Base heave
- c) Boiling
- d) Surcharge loading
- e) Vibration and other forces.



Shoring that uses soil arching is generally only suitable for excavations less than 2 meter deep and where each section of the excavation is open for less than one week.

When using shoring, make sure:

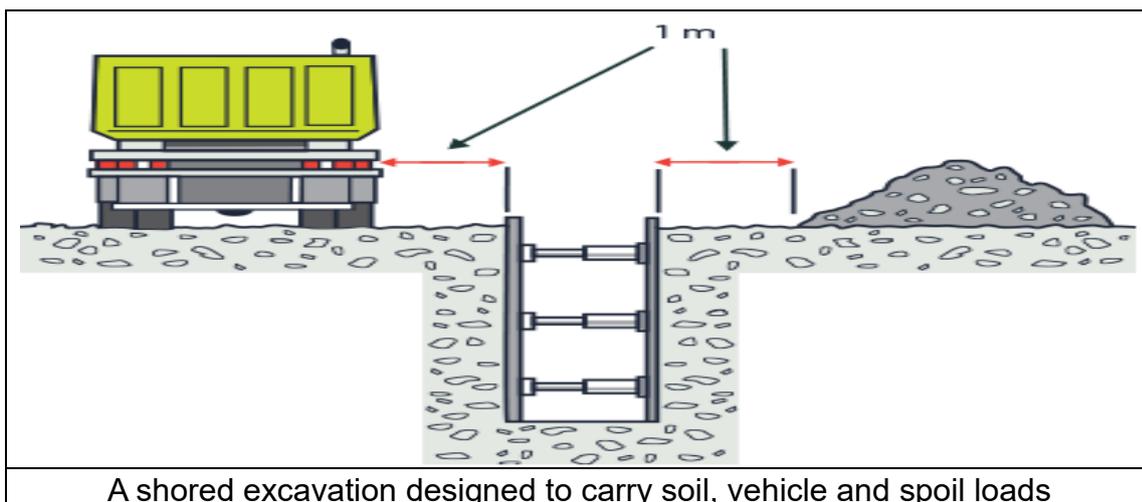
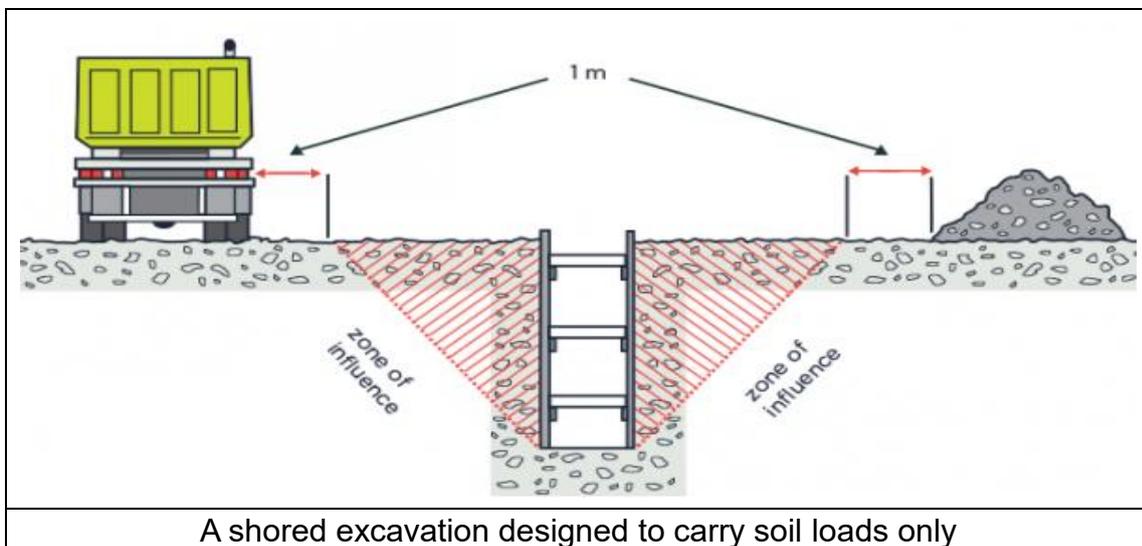
- a) the soil is good enough for the excavation to stand when excavated
- b) to install support as soon as practicable
- c) to achieve at least minimum pressure when pumping out hydraulic support and to maintain it
- d) to use a minimum of three sets of support with a maximum spacing of 1.5 meter

e) to minimize the length of time the excavation is open

### 9.6.7 Excavated Material and Loads near Excavations

The influence of any loads near the excavation can cause ground collapse. Any excavated material and external actions applying a load to the ground nearby can affect the excavation's stability through the zone of influence. The zone is normally from the base of an excavated face to the surface. The zone's angle will depend on site-specific factors.

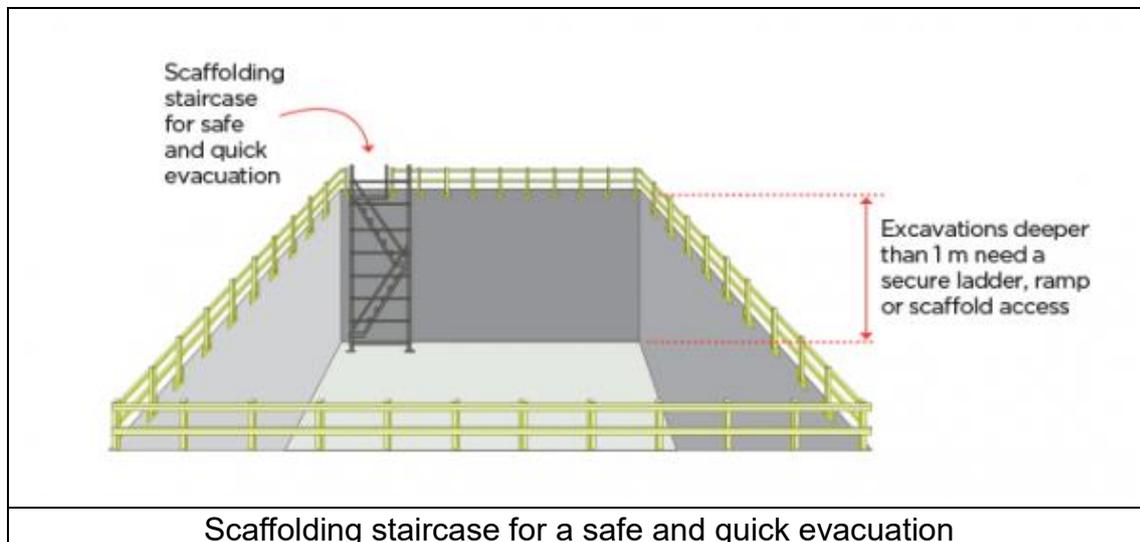
Mechanical plant, vehicles, spoil, or heavy loads should not be in the zone of influence plus 1 meter from an excavation unless specific design can show it can support the surcharge load.



### 9.6.8 Fall Prevention (Refer to Chapter 15 Fall Protection and Working at Height)

Controls to minimize the risk of falling may include but not limited to:

- a) Fall prevention devices (e.g. temporary work platforms, edge protection and guard rails) work positioning systems (e.g. industrial rope access systems).
- b) Fall arrest systems such as catch platforms.
- c) Using shoring itself (e.g. using trench box extensions or trench sheets taller than the excavation's depth). Where shoring extends above 200mm toe boards are not required.
- d) Installing and securing covers over excavations during non-work times.
- e) Installing guard rails and edge protection into the ground immediately around the excavation.
- f) Installing landing platforms or scaffold towers inside deep excavations.
- g) Securing ladders to shoring.
- h) Providing clearly defined pedestrian detours.
- i) Providing alternative access and egress points for emergency use.
- j) Backfilling the excavation as work progresses.



### **9.6.9 Manual Work (refer to Chapter 26 Health Issue)**

During excavation work, there will be circumstances that require some form of manual work including:

- a) Hand excavation
- b) Lifting
- c) Working in close proximity to plant and other workers.

Tasks which may lead to manual handling injuries include:

- a) Potholing with sharp hand tools
- b) Spotting/exposing underground services in close proximity to excavator buckets
- c) Frequently accessing trenches around existing services
- d) Installing and removing shoring and fall protection
- e) Placing heavy pipes into the excavation
- f) Using compacting equipment
- g) Using breakers
- h) Using drills.

Manual excavation methods are generally used for small, shallow excavations (eg less than 1.5 m deep) in soft soils. For some excavations, manual work such as trimming by hand will be required. Trimming can often be accomplished from outside the excavation by shoveling or pushing the material with a long-handled tool or shovel to the bottom of the excavation, where it can be picked up by mobile plant. Preparatory drilling activity and hand drills may increase the risk of musculoskeletal disorders, including vibration disorders.

Controls may include but not limited to:

- a) Creating exclusion zones around mobile plant and ground buckets – disengaging controls when spotters have to get close
- b) Keeping sites tidy and free from trip hazards and loose materials which may lead to slips
- c) Maintaining safe working spaces around workers
- d) Providing safe access and egress
- e) Rotating tasks and making sure workers take breaks
- f) Using correct lifting techniques to ensure solid footing

- g) Using plant to place and position shoring, props and plates, and remove compactors
- h) Wearing appropriate PPE.
- i) SWP

#### **9.6.10 Plant and Equipment**

Use suitable plant and equipment maintained in good condition to carry out excavation work safely. Various plant and equipment can carry out excavation work. Excavators in a range of sizes can:

- a) Extract soil from within an excavation
- b) Lift and move materials
- c) Install and remove shoring.

Make sure to use an appropriate excavator for the excavation work and properly plan and risk assess any lifting operations by the excavator before carrying out the operation.

To use plant safely:

- a) Make sure the plant is operated by a competent operator
- b) Fit suitable guards and protective devices
- c) Display the working load limit and make sure any load measurement devices are operating correctly
- d) Maintain plant in accordance with the manufacturer/supplier's instructions or relevant standards
- e) Fit excavators with an operating weight of seven tonnes or more with hose burst protection valves
- f) Carry out regular planned inspections and maintenance in accordance with the manufacturer's recommendations to make sure the mobile plant works safely, whether leased, hired, or owned
- g) Conduct both mechanical and electrical testing

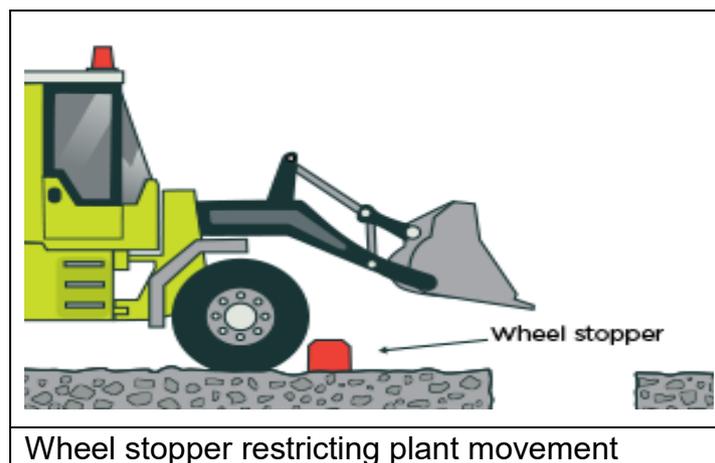
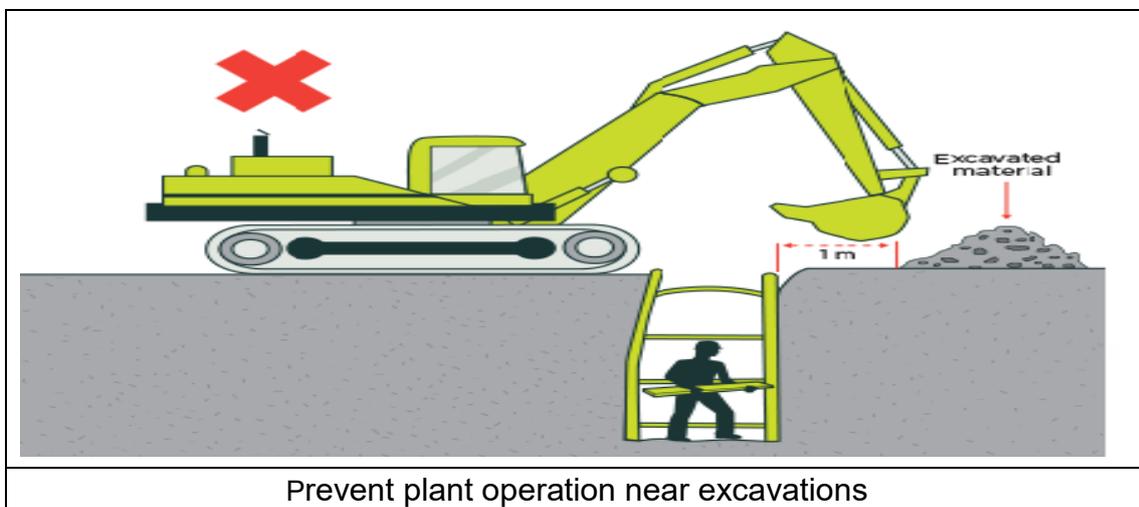
Carry out the following checks:

- a) Start checks on the general condition and maintenance of the plant
- b) Specifications or relevant standards.

Plant defects should be reported immediately to the contractor. If a defect is likely to pose an immediate or imminent risk to health and safety, remove the plant from service until the defect is fixed.

### 9.6.10.1 Plant and Vehicle Operation near Excavations

- a) Powered mobile plant should not operate or travel near the edge of an excavation unless the shoring can support such loads.
- b) Plant should approach end-on to excavations. If this is not practicable, make sure workers in the excavation get out when the plant is within the excavation's zone of influence or move away and stand further down the excavation.
- c) Workers should never stand under a load being lifted over the excavation.



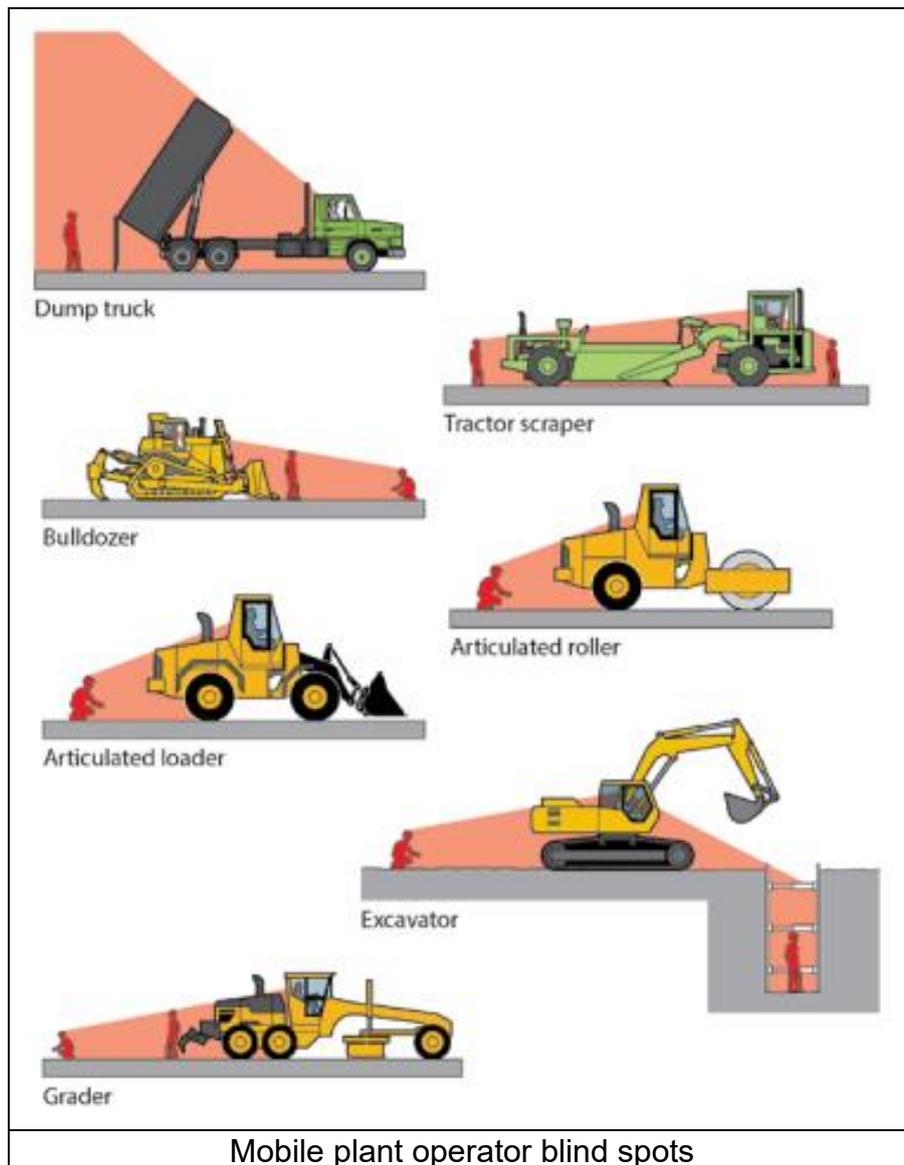
<b>Consider</b>	<b>Example Control</b>
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<b>Attachment failure</b>	<ul style="list-style-type: none"> <li>a) Use quick hitches to secure attachments</li> <li>b) Make sure the operator is familiar with and able to implement and manage any quick hitch used</li> <li>c) Make sure the operator checks any pins</li> </ul>
<b>Buried Contaminant (eg; asbestos)</b>	<ul style="list-style-type: none"> <li>a) Conduct a site assessment and carry out any remedial action</li> </ul>
<b>Lack of visibility</b>	<ul style="list-style-type: none"> <li>a) Make sure operators can see areas where people may be at risk from the operation of the machine</li> <li>b) Equip excavators with adequate visibility aids or use a banksman</li> </ul>
<b>Plant instability</b>	<ul style="list-style-type: none"> <li>a) Set up as per industry recommendations</li> </ul>
<b>Plant striking workers</b>	<ul style="list-style-type: none"> <li>a) Keep people away from areas of plant operation. Most excavator related deaths involve a person working in the vicinity of the excavator rather than the driver</li> <li>b) Use barriers, signage or a banksman</li> </ul>
<b>Spoil Placement</b>	<ul style="list-style-type: none"> <li>a) Safe distance of at least 1 m from edge.</li> </ul>
<b>Spotter/Signalman</b>	<ul style="list-style-type: none"> <li>a) use a trained banksman in a safe position to direct excavator operation and any pedestrian movements</li> <li>b) make sure the banksman and operator understand the signals they will use and agree on the way to communicate with each other</li> </ul>
<b>Strike Hazards</b>	<ul style="list-style-type: none"> <li>a) select plant with minimal tail swing if slewing in a confined area</li> <li>b) maintain over 1 meter of clearance between any part of the machine, particularly the ballast weight, and the nearest obstruction</li> </ul>

**Table 2 Typical Excavation Operation Hazards**

### 9.6.10.2 Blind Spots

Operators of powered mobile plant can often have severely restricted visibility of ground workers or nearby pedestrians, particularly those close to the plant.



Powered mobile plant operating near ground personnel or other powered mobile plant should be equipped with warning devices (for example reversing alarm and a revolving light).

An effective system of communication based on two way acknowledgement between mobile plant operators and ground workers should be established before work commences. Mobile plant operators and ground workers should be made familiar with the blind spots of particular items of plant being used.

# **CHAPTER 10**

# **SEWAGE AND DRAINAGE**

## Chapter 10 Sewage and Drainage

### 10.1 Introduction

A sanitary sewer is an underground carriage system specifically for transporting sewage from particularly a construction site covered in these best practice, through pipes to treatment facilities or disposal. Sanitary sewers are part of an overall system called a sewage system or sewerage. Sewage may be treated to control water pollution before discharge to surface waters.

### 10.2 Objective

Sewage:

- a) The purpose sewage of digestion is to reduce the amount of organic matter and the number of disease causing microorganisms present in the solids.

Drainage:

- b) To ensure that storm water and drainage water, primarily water from sand trap basins, is drained away to outlets in water channels or culverts, streams or rivers or sea.

### 10.3 Definition

Sewers shall be classified broadly with respect to use as follows:

- a) **Sanitary** - Sewer carry sewage from construction site, designed to remove certain construction wastes.
- b) **Storm** - Sewers carry storm water and surface drainage, street wash and other wash waters or drainage, but exclude sanitary sewage and industrial wastes and effluent from septic tanks or other treatment process.
- c) **Combined** - Sewers receive both sanitary sewage and storm runoff.
- d) **Collector** (main) - Sewers are those sewers to which one or more branch sewers are tributary and which serve as inlets to sewerage works system.
- e) **Intercepting** - Sewers received dry weather flow from a number of transverse sewers or outlets and frequently additional predetermined quantities of storm water (if from a combined system) and carry such water to a point for treatment of disposal.
- f) **Outfall** - Sewers receive sewage from a collecting system and/or a sewerage treatment plant and carry it to a point of final discharge.
- g) **Authorized Gas Tester** – a person who have the competency to carry out atmosphere test for confined space.
- h) **Permit to work** - a documented procedure that authorises certain people to carry out specific work within a specified time frame. It sets out the precautions required to complete the work safely, based on a risk assessment.

- i) Confined space** - means an enclosed or partially enclosed space that is at atmospheric pressure during occupancy and is not intended or designed primarily as a place of work:
- i. Is liable at any time to
    - Have an atmosphere which contains potentially harmful levels of contaminants.
    - Have an oxygen deficiency or excess.
    - Cause engulfment.
  - ii. Could have restricted means for entry and exit. e.g. Manhole, Silo, Tunnel, Pipeline, excavations, trenches

#### **10.4 Legal requirements**

- a) Building Operations and Work of Engineering Construction Regulation 1986
- b) Referred to INDAH WATER “Typical Civil and Structural Engineering Specification for Sewerage Works (Sewers, Force Mains, Pipe laying, Manholes and Appurtenances)
- c) Department of Work Malaysia - Standard Specifications for Building Works 2005 (Soil Drainage).
- d) ENVIRONMENTAL QUALITY ACT, 1974,
  - a) SECTION 29.Prohibition of discharge of wastes into Malaysian waters.  
(1) No person shall, unless licensed, discharge wastes into the Malaysian waters in contravention of the acceptable conditions specified under section 21.
- e) The Industry Code of Practice For Safe Working In A Confined Space 2010

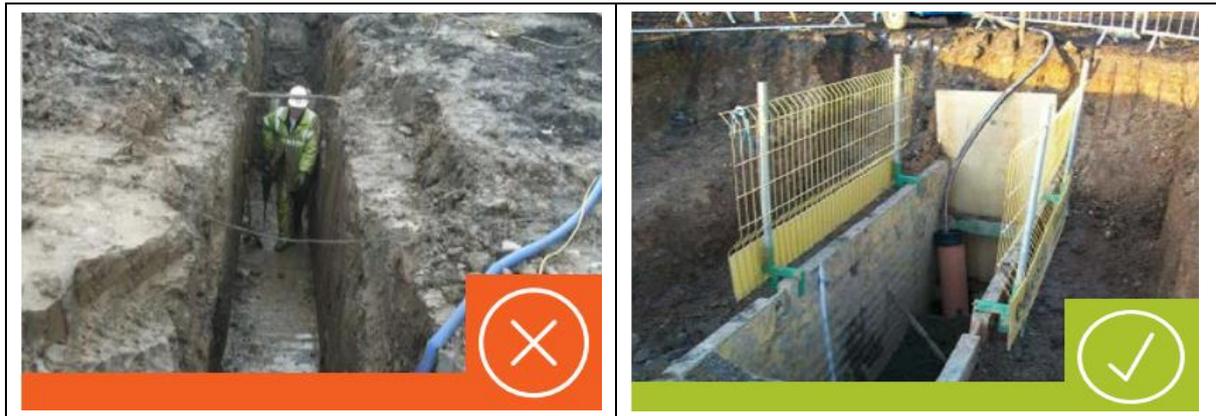
#### **10.5 Procedure**

- a) Safe Works Procedure (SWP) covered including the excavation, trenching, pipes & fitting, joint for drain pipes, pipe laying, concrete bed, hunching and surround, connections, manholes and inspection chambers, septic tank, filter bed & sewage treatment system and connection with public sewer.
- b) Jobs carried out with the availability of approved “Method of Statement”.
- c) The construction should have a good drainage system to ensure smooth drainage so that shouldn’t encounter stagnant water on ground.
- d) It is forbidden to pour any waste oil, poisonous and harmful substances directly into the drainage ditch and discharge it to the municipal pipe network.
- e) Slit trap shall be constructed and maintained including desilting when full.
- f) Construction site should set up an appropriate sedimentation tank, no sewage without sedimentation is allowed.
- g) Provide the sediment pond for collecting and trapping sediments before the water leaves the site. Sediment sedimentation tank over the capacity of 1/3 should be timely clean.

## 10.5.1 Construction of Sewage

### 10.5.1.1 Trenches and Excavations (Refer to Chapter 9: Excavation)

Trenches must be adequately supported, free from boulders and tree roots must be taken out. Muddy ground, water and soft areas in the trench base must be removed. Materials, spoil and equipment must be stored safely and plant should be operated within a safe working distance. The trench must be adequately protected from slips, trips, falls, site traffic and have a safe means of access and egress.



Trenches should be adequately dewatered to provide a firm base but not dug wider than necessary as excessive loading may be placed on the pipe. Should ground conditions be unsuitable for pipe laying and manhole construction, please consult with your engineer to design a solution.

### 10.5.1.2 Control of Site and Trench Groundwater

The discharge of site ground water and excavation dewatering to the public sewer is only permitted by approval from Department of Environment, Malaysia in writing. In addition, care must be taken to prevent site debris, sludge or silt from entering the sewer network which could ultimately cause flow restrictions, blockages, flooding, and pollution and also affect the receiving wastewater treatment works. Costs associated with such incidents may be recovered from those responsible. In addition, should an inappropriate discharge of site groundwater or construction material because a pollution incident, this may lead to prosecution.



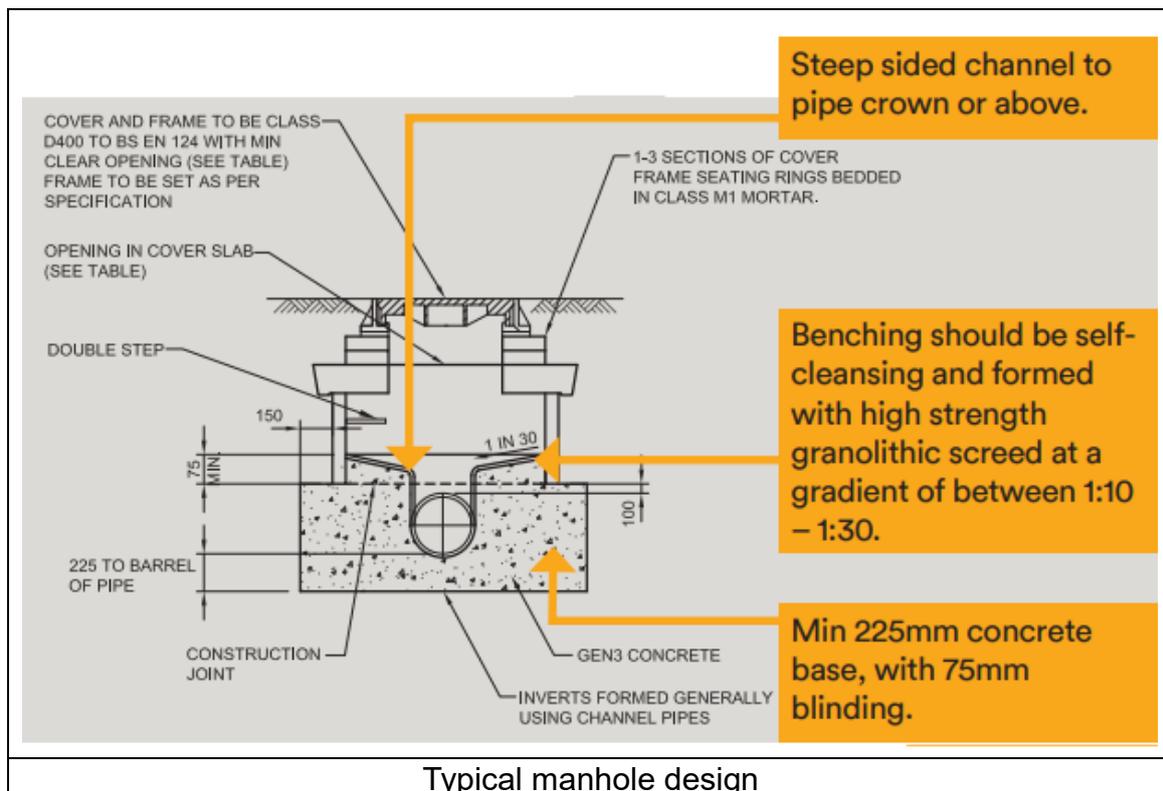
### 10.5.1.3 Agreed drawings

For sewer adoption and diversion works, construction must comply with the drawings agreed by Department of Work, Malaysia. Similarly for public sewer connections, works must comply with the details which have been agreed by the Town Counsel, the relevant Building Control Authority and the approval given by Department of Work, Malaysia for the works to proceed.

It is recommended that a site copy of the agreed drawings are available to those carrying out construction to avoid any mistakes or deviation from specification. Any deviation from the agreed drawings must be agreed with Department of Work, Malaysia before construction.

### 10.5.2 Construction of Manhole

Typical manhole chambers up to 3m deep. Manholes should be constructed where there is a change of direction or a change of gradient, or where access is required for maintenance purposes. Such changes in direction or gradient must be made within the channel and not outside of the manhole or concealed by benching. Manholes should also be positioned 0.5m away from curb lines, preferably with the manhole cover positioned away from the wheel line of traffic.



Manhole bases should be sized to accommodate the main channel, lateral connection channels and provide a minimum 600 x 600mm square landing area beneath the step rungs or ladder for main channels up to 375mm. However, should there be several channels, the size of the chamber may need increased. Please note, road cambers should be considered when positioning manholes with double covers across the center of a carriageway.

The manhole base should be a minimum of 225mm deep to the barrel of the channel. To prevent the ingress of ground water and associated calcified deposits bleeding through the benching, the concrete should not be a dry mix and sufficiently compacted to remove voids and entrained air. Channels must be steep sided to at least the crown of the pipe.

### **10.5.2.1 Hazard Associated with Manhole**

Working near or in a manhole inherits potential dangers which may result in serious accidents. The common ones include falls/slips, fire or explosion, oxygen depletion, gas poisoning, heat stress, drowning, asphyxiation arising from gas, fume, vapor and entrapment by free flowing solid. Amongst which, dangers involving gases are easily overlooked or neglected, leading to serious casualties.



### **10.5.3 Confine Space**

The key characteristics of a confined space are:

- a) The space must be substantially enclosed.
- b) There must be a risk of at least one of the hazards listed above occurring within the space.
- c) The risk of serious injury from the hazard must be created by virtue of the enclosed nature of the space.
- d) The potential injury must be serious and be such as to require emergency action to rescue the person involved.

#### **10.5.3.1 General Requirement**

- a) The employer shall determine if his facility has any confined space, and if so, develop and maintain a record of confined spaces.
- b) If a place of work has a confined space, the employer shall inform his employees and any other persons, by posting danger signs or by any other equally effective means, of the existence and location of the confined space, and the danger posed by them, especially when work is being executed. A sign reading “DANGER --- CONFINED SPACE. DO NOT ENTER” or using other similar meaning.
- c) If the employer decides that his employees have to enter a confined space, the employer shall develop and implement a confined space entry programme. This programme shall be documented and made available to the employees.
- d) If the employer decides that his employees shall not enter a confined space, the employer shall take effective measures to prevent his employees and any other persons from entering the confined space.

#### **10.5.3.2 Risk Management**

Conducting risk management is the key to reducing risks related to entering and working in confined spaces. Everyone, from employer to worker, must work together to ensure that the risk assessment process identifies any expected risk and adopt all reasonably practicable measures to make the confined space safe to enter and work in. It is important that the risk assessment in confined space work is conducted by knowledgeable and experienced personnel.

Key in conducting risk management of the confine space may include but not limited to:

a) Assess need for entry into a confined space

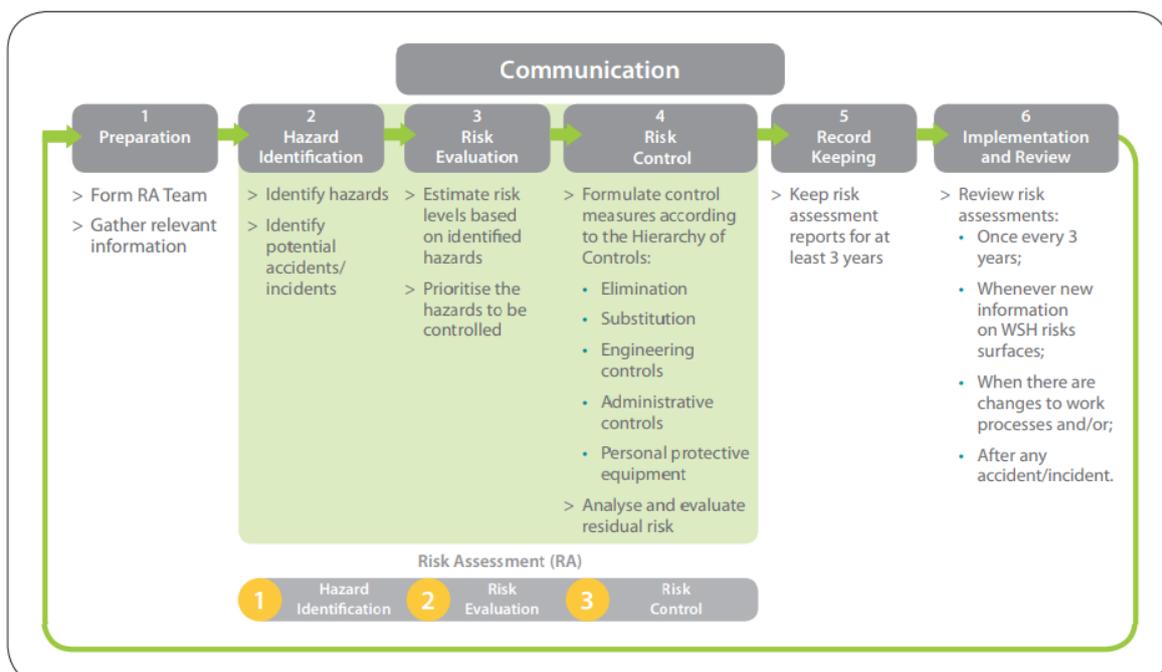
Before attempting to enter or work in a confined space, it is important to consider the possibility of using alternatives and other methods to do the job without entering the confined space. Entry into or work in a confined space should only be a last resort.

b) Identification and evaluation of confined spaces

All confined spaces shall be clearly identified, documented and labelled. It includes any equipment that constitutes a confined space in the workplace. The document should contain the particulars of the types of confined spaces and their services. For the equipment record, it is important to also include its type and identification number. It is critical to identify and evaluate each confined space to determine whether it has chemical or physical hazards. It is advisable not to assume that a confined space is hazard-free. Different chemical and physical hazards may be introduced through various work activities inside the confined space.

c) Control of Confined Space Hazards

It is important to follow the steps in the hierarchy of control measures to manage the identified risks:



### **10.5.3.3 Safe Working Procedure (SWP)**

If entry to a confined space is unavoidable, SWPs should be established and implemented for work which may pose safety and health risks. The SWPs should include safety precautions to be taken in the course of work and during emergencies, as well as responsibilities of persons involved and provision of PPE. The implementation of the SWPs should be monitored regularly, and the SWPs reviewed periodically to ensure their currency.

Safe Work Procedures must include, but not limited to:

- a) Regulatory requirements;
- b) Required permits;
- c) Necessary personal protective equipment;
- d) Required training;
- e) Worker responsibilities;
- f) Specific sequence of steps to follow to complete the work safely; and
- g) Emergency procedures.

An example of a task that requires the development of a safe work procedure is confined space entry. Individuals who must work within confined spaces must ensure that safe work procedures are developed and followed to maximize life safety.

Make sure that the safe system of work, including the precautions identified, is developed and put into practice. Everyone involved will need to be properly trained and instructed to make sure they know what to do and how to do it safely.

### **10.5.3.4 Permit to Work Procedure**

A permit to work procedure is a means of achieving effective control of a system of work through formal written documentation known as a permit to work form. The essential components of a permit-to-work system include:

- a) A written procedure, which sets out how the system is to operate and clearly defines who may authorize particular jobs and who is responsible for specifying and implementing the necessary precautions.
- b) A form, known as the "permit-to-work form", which becomes a written and signed statement ensuring both the establishment of safe conditions for the work to commence and the maintenance of safe conditions for the duration of the work, including the provision of emergency arrangements.

- c) A method of informing the persons carrying out the work of the exact identity, location, nature and extent of the job, the hazards involved and the precautions to be taken.
- d) A system for ensuring the safe hand-back of the workplace after the job is completed and, in the case of confined space entry, after the space is vacated.

#### **10.5.3.5 Communication**

An effective and reliable means of communication among entrants inside the confined space, and between entrants and attendants, is required. When choosing a means of communication, it is advisable to give careful consideration to all anticipated conditions inside the confined space (e.g., visibility, possibility of a flammable atmosphere, and noise levels) and to the personal protective equipment in use (e.g., ear muffs and breathing apparatus).

The communication system used can be based on speech, hand signals, telephone, radio, and so on. Whatever system is used, it is important that all messages can be communicated easily, rapidly and unambiguously between relevant people. It is important to take note on the limited penetration of radio signals into buildings, vessels and below-ground structures. The advantages of having a person outside the confined space in direct voice and visual contact with the entrants are clear. This also facilitates the monitoring of entrants for the symptoms or behavioral effects of exposure to hazards.

It is important that confined space entrant(s) are informed quickly if a situation arises on the outside which could endanger the entrants, such as problems with a supplied air system or ventilation system. It is essential that the means of raising the alarm and setting in motion the emergency rescue procedures are effective and reliable. It is also necessary that the line of communication be available at all times during the work.

It is required to have an appropriate means of communication between the person working inside a confined space and the attendant stationed outside, whether by voice, rope tugging, tapping or by a battery-operated communication system specially designed for confined space use.

Note that radio frequency/wireless devices do not work effectively in confined spaces such as tanks or sewers, where there is metal or concrete shielding between the interior of the space and the outside. Body alarm devices may be useful in a confined space where communication between entrants and attendants is difficult. These are designed to sound if the wearer does not move during a specified period of time.

### 10.5.3.6 Purging and Ventilation

When a confined space is known to contain hazardous contaminants, it is crucial to purge the space adequately before any entry. It is also important to note that purging and ventilation do not exclude the need for gas testing by authorized gas tester.

Purging of a confined space is conducted before any entry and the purpose is to remove any existing contaminants by displacing the hazardous atmosphere with another medium such as air, water, steam or inert gases. The choice of a suitable medium will depend on factors such as nature of the contaminants and their concentrations.

It is unsafe to enter any confined space when adequate ventilation is absent. Adequate and effective ventilation is required throughout the validity period of the entry permit. Even when the confined space has been certified safe for entry, new contaminants may be introduced from the change in conditions, or when work performed in the space such as welding releases new contaminants.

As such, it is important to provide an adequate and effective ventilation to always maintain the contaminants concentration level as low as possible, and the level of oxygen within safe range. Due to the unique characteristics of confined spaces, natural ventilation is usually not adequate and would require the use of mechanical ventilation. Mechanical ventilation can largely be classified into two main types:

- a) Forced (supplied) ventilation
- b) Local exhaust ventilation (LEV)



Example of Forced Ventilation	Example of LEV
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Factors to consider in determining the type of ventilation to use include:

- a) The nature of contaminants
- b) The configuration of the space
- c) The expected work to be performed in the confined space

#### **10.5.3.7 Training**

Training is critical in all work with confined spaces. Ensure that all employees are given suitable and appropriate training to carry out the workplace task. This will include emergency procedures and if required training in the use of breathing apparatus.

Suitable workers should meet the following requirements:

- a) Have received training to become “certified workers”
- b) Have sufficient experience in the type of work to be carried out
- c) Have a suitable build for the work if the risk assessment highlights exceptional constraints as a result of the physical layout
- d) Be fit to wear breathing apparatus if the work requires the use of such apparatus, and there is no medical advice against an individual’s suitability to work in a confined space.

#### **10.5.3.8 Emergency Procedure**

Emergency arrangements must put in place before any work starts. The suitable and sufficient measures in place to make sure employees can be rescued safely if required. Emergency procedure should include but not limited:

- a) First aid procedure
- b) The safety of the rescuer
- c) Liaison with emergency services

There must be appropriate to the hazard presented by the activity:

- a) There must be an effective means of communication for raising the alarm both from the confined space and by someone outside.
- b) Work in confined spaces is often carried out at night, weekends and times when the premises are closed, for example holidays. Consider how the alarm can be raised.
- c) Provide rescue and resuscitation equipment. This will depend on the likely emergencies identified.

- d) It may be necessary to shut down any adjacent plant before attempting emergency rescue. Ensure access and a means to safely shut down is available
- e) Consider how the local emergency services would be made aware of an incident. Plan what their route of access is. Also consider what information about the dangers need to be given to them on their arrival.

#### **10.5.4 Drainage System**

Removing storm water, construction and living quarters wastewater is an important environmental health intervention for reducing disease. Poorly drained storm water forms stagnant pools that provide breeding sites for disease vectors. Because of this, some diseases are more common in the wet season than the dry season. Construction and living quarter's wastewater may also contain pathogens that can pollute groundwater sources, increasing the risk of diseases such as lymphatic filariasis. Poor drainage can lead to flooding, resulting in property loss, and people may even be forced to move to escape floodwaters. Flooding may also damage water supply infrastructure and contaminate domestic water sources.

##### **10.5.4.1 Design**

Designing and constructing drainage systems require expert advice from engineers to make sure that water flows away quickly and smoothly and is disposed of in a surface watercourse or soak away. Drainage installed by construction should not create problems for other communities downstream, nor should it affect ecologically important sites. Environmental considerations should be given adequate attention: long-term changes to the environment may lead to greater health problems in the future.

##### **10.5.4.2 Disposal Condition**

Depending on the location, hydrology and topography of the drainage basin, drainage water might be disposed to open surface water bodies, e.g. rivers, lakes, outfall drains, and oceans. The oceans are often regarded as the safest and the final disposal site for drainage water. This is true unless drainage water is contaminated with sediments, nutrients and other pollutants and the disposal site is in the vicinity of fragile coastal ecosystems such as mangroves and coral reefs.

Therefore, at the point of discharge, pollution may be of much concern. In general, oceans have significant dilution or assimilative capacity. However, this is also limited in many cases especially in enclosed and semi-enclosed seas. Inland drainage water disposal to freshwater bodies such as lakes and rivers requires care. Rivers are normally used for different water use purposes requiring certain qualities of water, while the accumulation of salts and other pollutants in freshwater lakes threatens ecosystem

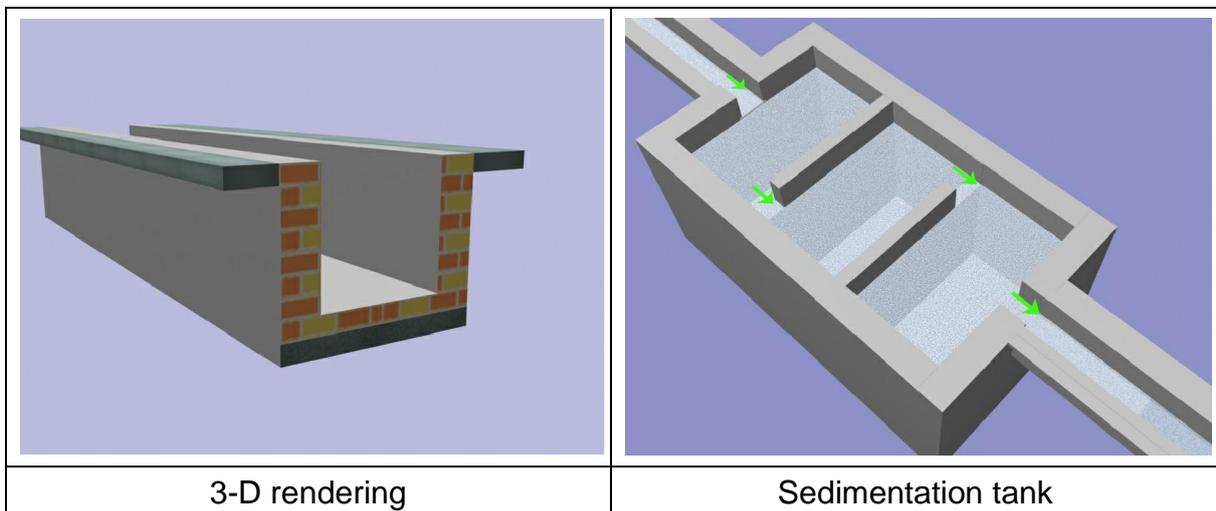
functions and aquatic life.

**For contaminated water discharge sedimentation tank must be built to ensure the water discharge is treated physically before it discharge to the open water.**

#### How to keep drainage workers safe;

- a) To ensure all working on the drainage network have completed their confined space training before carry-out the works.
- b) Ensuring workers are able to constantly learn and develop their skills via appropriate training.
- c) To ensure carry out regular risk assessments.
- d) To make available safe system of work in place.
- e) To ensure the correct use of provided appropriate tools and personal protective equipment.
- f) Safe excavations and trenches activity should refer to relevant Chapter (for Excavation and Trenches)

#### Photo





Joint for drain pipe



Sewage system

# **CHAPTER 11**

# **FOUNDATION**

## Chapter - 11 Foundations

### 11.1 Introduction

A foundation work in construction is the element of an architectural structure which connects it to the ground and transfers loads from the structure to the ground. Foundations are generally considered either shallow or deep.

### 11.2 Objective

- a) To distribute the load of the structure over a large bearing area so as to bring intensity of loading within the safe bearing capacity of the soil lying underneath.
- b) To load the bearing surface at a uniform rate so as to prevent unequal settlement.
- c) To prevent the lateral movement of the supporting materials.
- d) To secure the level surface and firm bed for building operations.
- e) To increase the stability of the structure as a whole and prevent overturn.

### 11.3 Definition

- a) **Footing** - They are typically made of concrete with rebar reinforcement that has been poured into an excavated trench. The purpose of footings is to support the foundation and prevent settling
- b) **Foundation** - Part of a structural system that supports and anchors the superstructure of a building and transmits its loads directly to the earth.
- c) **Derricks** - lifting device composed at minimum of one guyed mast, as in a gin pole, which may be articulated over a load by adjusting its guys.

### 11.4 Legal requirements

- a) FMA 1967 Act 139 Regulations (BOWEC) 1986 Part XII Sect. 111 to 118.
- b) FMA 1967 Act 139 Regulations (BOWEC) 1986 Part XIV Sect. 124 to 134.
- c) DOSH Guidelines on trenching for construction safety (Year 2000).
- d) Guidelines on Occupational Safety and Health in Construction Industry (Excavation Work) 2017

## **11.5 Procedure**

### **11.5.1 Site clearing, stripping and levelling (Refer to Chapter 7: Site Clearing)**

- a) Clearing of the site by removing, rubble, grass, shrubs, and trunks and also ensuring that there is no water stagnation by incorporating a proper drainage system.

### **11.5.2 Setting out and excavation (Refer to Chapter 9: Excavation)**

- a) After setting out, the digging up of the foundation trenches may commence, as specified in the building plans, these excavations have to be supervised strictly because any shortcuts made on the foundation will affect the entire structure.

### **11.5.3 Footing**

- a) Concrete of a specified mix is prepared and poured into the excavated trenches up to a specified thickness and width.

### **11.5.4 Foundation Wall (plinth wall)**

- a) A wall built from the concrete strip footing to the height of the foundation slab, the thickness of the foundation wall may vary from site to site, so the walls are built as the building plans specify.

### **11.5.5 Backfill and dump proofing**

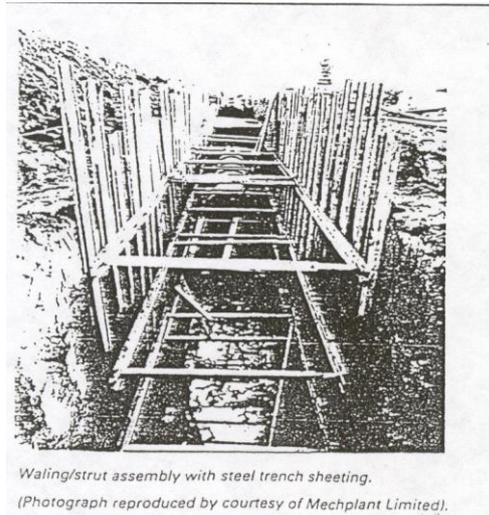
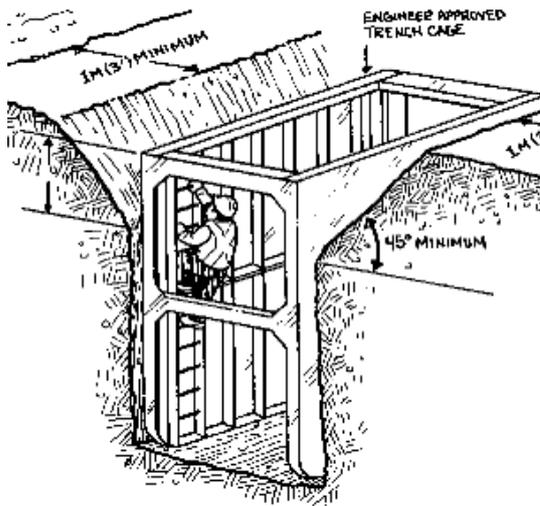
- a) The inside of the built foundation walls must be filled to a required level, either by using the excavated soil, or ferried one, this soil should be compacted in layers to get desired results.

### **11.5.6 Foundation Works**

- a) Duly complete the excavation checklist prior to commencement of excavation operation.
- b) Determine any underground installations such as sewers, power cables, telephone lines, and water and gas services prior to commencement of excavation.
- c) Special precautions must be taken to avoid damage to the underground services, e.g. not to use excavator if at around the depth of the services.
- d) Excavations and trenches of 1.5 meters or more in depth shall be sloped, stepped in an approved manner or provide adequate shoring to prevent soil cave in or collapse.

- e) Ladders shall be provided in excavations & trenches of 1.2 metres or more in depth to ensure safe entry and exit. A ladder or run of ladder between any two successive landings shall not exceed 9 metres. Ladders shall be extended from the trench bottom to at least 1.0 meters above the ground level.
- f) Excavated or other materials shall be stored at least 1000mm away from the edge of any excavation.
- g) Excavated trench shall be inspected daily by designated person. If there is any evidence of cave-ins or slides, all work shall be ceased until all necessary precautions have been taken to ensure safe condition.
- h) All trenches exceeding 4 meters in depth, shoring, sheet piling or any other soil support systems shall be designed and drawing of a Professional Engineer.
- i) Adequate barricades shall guarded at open sides of excavations where a person may fall from a height of more than 1.5 meters and suitable warning signs in placed where they can be seen.
- j) Excavated material shall be kept back at a safe distance of at least 1 meters away from the edge of the excavation.
- k) Whenever possible power machines used for excavating shall be positioned so that the operator is on the side away from the bank.
- l) Ramps and runways entering excavations shall be wide enough for men and vehicles. They shall be substantially constructed and properly braced and supported and shall be provided with guardrails. When inclined over one-in-eight (1:8) walkways shall be properly secured.
- m) Workmen engaged in scaling, sloping or trimming works should use safety ropes.
- n) If derricks or other heavy objects are placed close to the edge of an excavation additional bracing shall be installed to support the extra pressure due to increased load.
- o) Road crossings or designated temporary passage crossing trench shall place a steel plate of adequate thickness over the entire trench prior to allow passing of load trucks or construction vehicles traffic.

## 11.6 Trench shield or shoring



- a) The prevention of water accumulation inside excavated trench must take measures to ensure by the use of diversion ditches, dikes, or other suitable means to prevent surface water from entering an excavation and to provide adequate drainage of the adjacent area. In addition, a competent person must inspect excavations subject to runoffs from heavy rains.
- b) An authorized gas tester must test any excavation deeper than 4 feet (1.22 meters) or where an oxygen deficiency or a hazardous atmosphere is present or could reasonably be expected, such as a landfill or where hazardous substances are stored nearby, before a worker enters it. If there are any hazardous conditions, must provide the employee controls such as proper respiratory protection or ventilation. In addition, the sub-contractor are responsible for regularly testing all controls used to reduce atmospheric contaminants to acceptable levels.
- c) If hazardous atmospheric conditions exist or develop in an excavation, must provide emergency rescue equipment such as a breathing apparatus, safety harness and line, and basket stretcher and ensure that it is readily available.
- d) All reinforcement starter bars in excavations (any depth) must be protected to prevent the possibility of puncture injuries.
- e) Do not alter or remove any supporting members unless under the direct supervision of a designated person.

### **11.7 Inspection by Designated Person**

- a) Inspect excavated trench daily, before work starts, after a rainstorm, or during other inclement weather conditions such as high winds.
- b) Observe for evidence of potential cave-ins, indication of failure of protective systems, hazardous atmospheres or other hazardous conditions

### **11.8 Road Works**

The following procedure should govern while carrying out road works:

- a) Adequate warning signs should be provided at approaches at least fifty (50) meters from the working area.
- b) Adequate detours should be provided when road is under repair or is not passable.
- c) Blasting areas should be cleared within a safe distance and adequate warning signals shall be used.
- d) Railings may be provided on deep embankments and narrow portions.

**Note:** Workmen should not be permitted to work when weather conditions create a hazard.

### **11.9 Piling Works**

- a) Where there is any question of stability of structures adjoining areas to be piled, such structures should be supported where necessary by underpinning, sheet piling, shoring, bracing or other means in accordance with the design of a Professional Engineer to prevent injury to any person.
- b) All pile-driving equipment should be inspected daily by a designated person before the start of work in accordance of daily checklist and every defect shall be immediately corrected before pile-driving commences. Every piling frame and its attachments must be thoroughly examined by an approved person at least once in every twelve months.
- c) The operator of every pile driver must be protected from falling objects, steam, cinders and water by a substantial covering.
- d) The operator must carry out daily inspection of piling machine in accordance of daily operator's piling equipment checklist before commencement of work on each day.

- e) Each member of the pile-driving crew must be properly instructed in the work he is to do and the operation shall be in the charged of a designated person who must personally direct the work and give the operating signals
- f) The preparation of the piles must be done at a safe distance from the driving operation. During the hoisting of piles, all persons not actually engaged in operating the equipment and handling the piles must be kept out of the area
- g) When the pile driver is not in use, the hammer must be choked or blocked in the leads or lowered to the ground
- h) A ladder extending from the bottom of the leads to the overhead sheaves shall be permanently attached to the structure supporting the leads
- i) Where a structural tower supports the leads, suitable working platforms of adequate strength shall be provided on levels of the leads at which it is necessary for men to work. Such platforms should be provided with a safety railing and toe-board on all sides, except on the hammer or lead side of the platform. Where such platform cannot be provided, a safety belt shall be provided
- j) All concrete piles must have attained the required strength before being hoisted or being subject to piling stresses

#### **11.9.1 Pile testing**

- a) The testing of piles must be conducted under the direct supervision of a designated person.
- b) Reasonably practicable measures must be taken to warn persons not to approach within 50 metres of a pile under test.
- c) Under no circumstances shall anyone be permitted to approach a test pile while the process of increasing or decreasing test loading is being carried out.
- d) While the process of increasing or decreasing test loading is not in progress, anyone approaching a test pile for any purpose must only be permitted to do so under the specific instruction of the designated person who shall take reasonably practicable measures to ascertain that the Kent ledge is in a stable condition and is safe for approach.
- e) To carryout inspection in accordance of test pile operation checklist.

Before placing or advancing a pile driver, the ground shall be inspected by a designated person and, where necessary for firm and level footing, timber shall be placed. After placing or advancing a pile driver, inspection and correction of the footing shall be made, when necessary, to maintain stability.

[ Referred to relevant Chapter 9 Excavation Work ]

### 11.10 Hazard – (Risk of activities)

A risk management must be undertaken for the whole activity at foundation stage.

[ Referred to Risk Assessment subject to Excavation, etc. ]

### 11.11 Control Measure – (Preventions measures - Safe work practice)

Relevant Safe Operation Procedure (SOP) deems required to assist in developing and controlling to any potential to cause harm to persons, construction site, materials or the environment as identified from the results of risk assessment.

#### Photo



Piling cap



Cutting process



Piling



concrete

# **CHAPTER 12**

## **MATERIAL LOADING PLATFORM**

## Chapter 12 Material Loading Platforms

### 12.1 Introduction

#### About Material Loading Platform:

Loading platforms are essential for bringing materials into and out of a building on a work site. Loading platforms consist of a cantilevered platform extends from the building on one half and the other half going into the building with columns that are secured to the floor and roof of the building.

Giant Leap obligation to ensure platform have a Safe Working Load (SWL) that should be marked clearly on the platform. It is important to know that the Safe Working Load assumes an evenly distributed load across the platform, as most loads won't be evenly distributed it is good idea to work a bit under the Safe Working Load (SWL).

### 12.2 Objective

- a) All building materials shall be load / unloaded thru material loading platform in a safe and orderly manner so as not to obstruct place of work.
- b) Materials loaded/ uploaded shall be stacked in such a manner as to ensure stability while work with material loading platform.
- c) Materials shall not load / uploaded upon platform in such quantity as to exceed its safe carrying capacity stated at SWL attached with.
- d) Materials shall not be loaded / uploaded so close to any edge of platform as to endanger persons below.
- e) Debris or any materials waste should be handed through platform which will not endanger persons.

**[ BOWEC Regulation 22 (1) ]**

### 12.3 Definition

- a) **Material Loading Platform** – Temporary platform which is used to loading/unloading material.
- b) **Banksman** – Person who direct operation of a crane or larger vehicle from the point near where loads are attached and detached.
- c) **Professional Engineer** – a person registered as professional engineer under the Registration of Engineer Act 1967 ( revised 2015)

## **12.4 Legal requirements**

In these best practice, unless the contract otherwise requires;

- a) SWL means Safe Working Load designed and endorsed by P.E.
- b) To comply with such of the requirement of these best practice as relate to any loading / uploading activity thru material loading platform.
- c) No employees shall do any loading /uploading activity thru material loading platform not in accordance with the generally accepted principles of sound and safe practice.

[ FMA 139 (BOWEC) Regulation 4 ]

[ FMA 139 (BOWEC) Regulation 21 ]

[ FMA 139 / Section 10 ]

[ FMA 139 / Section 26 ]

[ Guidelines for Public Safety and Health at Construction Sites / 16.0 Removal of Debris ]

- d) Factories And Machinery (Building Operations And Works Of Engineering Construction) (Safety) Regulations 1986

## **12.5 Procedure**

### **12.5.1 Design & Construction:**

- a) It is the responsibility of the main contractor to provide & maintain loading platforms.
- b) The loading platform design must be approved and endorse by a Professional Engineer
- c) Suitable edge protection must be provided to the edges where persons and/or materials can fall.
- d) Any loading platform gates must provide ridged edge protection.
- e) Cantilever loading platform installation shall have constructed plan through PE approval design and comply with all the specifications.
- f) Cantilever loading platform designed with SWL of maximum 800kg.
- g) The main frame is welded with 16 inch I-beam and the upper path is 50 x 100 x 2000mm., surface use 18mm plywood with firmly secured or 2mm steel plate welded on the sub keel.
- h) Cantilever loading platform must connected with building structure.
- i) Cantilever loading platform on both sides of the set of two removable 1200mm high safety barrier, barrier and cantilever I-beam plug connection, and safety barrier inner use 1.2mm thick steel plate closed.
- j) Cantilever loading platform is provided with two fan 480mm (wide) x 550mm (high) double door, frame use welding production of 25mm x 50mm steel with thickness of 1mm, frame inner use 30 x 30 steel net and install safety net.

- k) Cantilever loading platform height is 3m. If the change of storey height or the cantilever length changes greatly, the calculation should be recalculating.
- l) The construction site prohibit the use of steel tubular cantilever loading platform, tool type loading platform installed at the opening of the frame, must strengthen the frame structure.
- m) Recommended that cantilever loading platform, to according to the actual situation of workplace but an obligation to have PE approval design.

#### **12.5.2 Positioning & Loading**

- a) The location of loading platforms should be decided by the main contractor.
- b) Locate loading platforms so that they do not create a snag hazard for the site tower cranes.
- c) Load material such that it does not exceed the guardrail height.
- d) Loading activity shall be performed in the presence of competent banksman.

#### **12.5.3 Test / Certification**

- a) Material loading platform shall be tested through PE approved design for each interval of every three months.
- b) Loading platforms must also be tested whenever modified or relocated.
- c) Clearly display Safe Working Load (SWL) of each loading platform at both side of cantilever loading platform.

#### **12.5.4 Notices & Rules**

- a) The area under the loading platform shall be barricaded appropriately.
- b) Display adequate warning signs & notices for the safe use of platforms.
- c) All notices and warning signs must be in national language (Malay Language) and then with other language that understood by the workforce.

#### **12.5.5 Training & Inspection**

- a) All workers involved in the use and loading of loading platforms must be instructed on the agreed safe system of work.
- b) A competent person (professional engineer who endorse the design) must undertake a formal documented inspection of every loading platform at least weekly.

General Note:

- i. The upper pull point of the dismantle platform must be located on the building, cannot set up on the scaffold and other construction equipment. Each steel rope must be embedded with a hanging ring, which is subjected to single force.
- ii. Installation should be slightly higher than the outer side of the platform.
- iii. All channel connection use welding, weld height is not less than 8mm, and weld should be full. Ensure the I-beam upper surface was in the same level.
- iv. All horizontal members and vertical posts are fully welded.
- v. After the cantilever dismantle platform is finished, the platform welding quality must be checked and accepted.

## **12.6 Hazard**

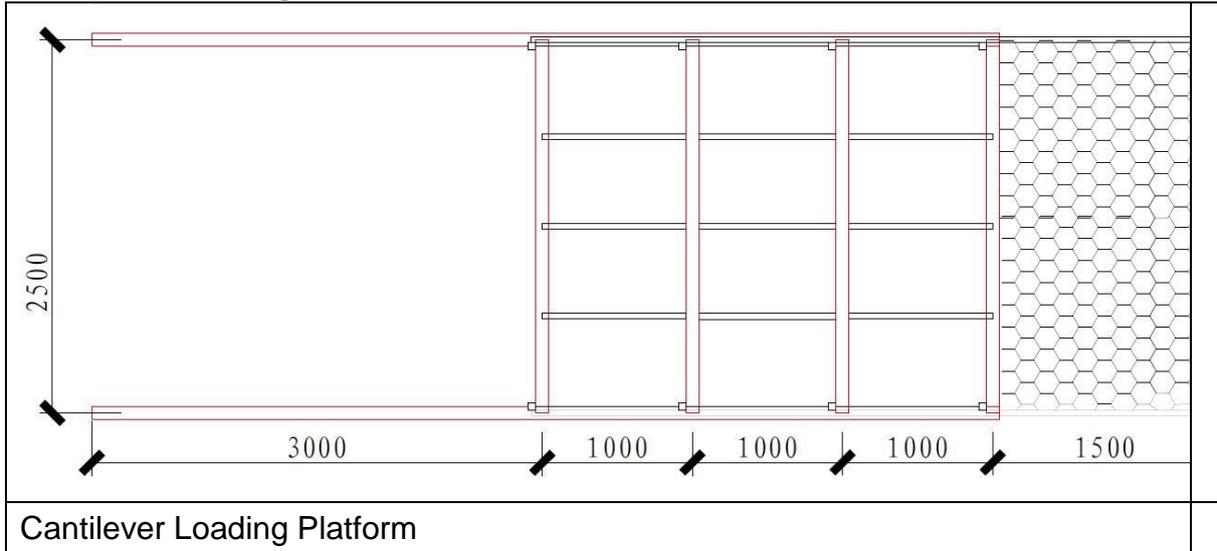
a) Risk management :

- i. A risk management must be undertaken for the design, installation, use and removal of loading platforms.
- ii. A method statement must be prepared covering the procedure for the safe use of the loading platform

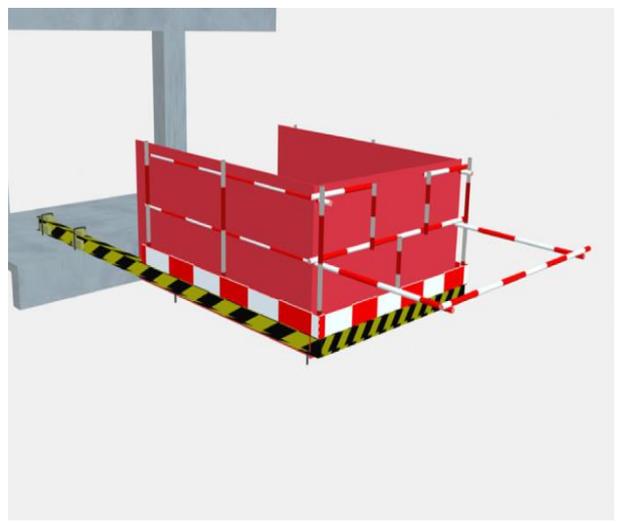
## **12.7 Control Measure – (Preventions measures - Safe work practice)**

Relevant Safe Operation Procedure (SOP) deems required to assist in developing and controlling to any potential to cause harm to persons, construction site, materials or the environment as identified from the results of risk assessment.

**Example Photo Figure:**



Cantilever dismantle platform figure



Three-dimension figure



Actual on site view



Loading Platform

# **CHAPTER 13**

## **SCAFFOLD**

## Chapter 13 Scaffold

### 13.1 Introduction

Scaffold is one of the vital elements in construction industry to facilitate the flow of building construction progress by providing temporary working platform, building perimeter protection, false work or formwork shoring support, materials loading platform, catch platform or independent working platforms that requires for building construction activities.

### 13.2 Objective

- a) To ensure safe construction and the scaffold complies to stipulated regulation.
- b) Understand the scaffold procedures and implement the statutory measures which prevent hazards that involves in the construction industry.

### 13.3 Definition

- a) **Designated person** – an authorized person that approved or assigned by the employer to perform specific duty.
- b) **PE Design** - Design produced by professional engineer that license and approve by the state.
- c) **Scaffold Inspector** - Competent person whose combination of knowledge, training, experience and registered with DOSH to carry out inspection of the scaffold.
- d) **Scaffold Erector** - Trained worker who expert in installing, dismantling, or modification of scaffold.
- e) **Safe working load** - the maximum load calculated in accordance with sound and accepted engineering practice, which supported safely under normal working condition.

### 13.4 Scope

- a) Elevated external scaffold work on building face.
- b) Peripheral scaffold & peripheral net to protect against debris drop beyond the building perimeter.
- c) Structure support scaffolds for concrete formwork.
- d) Scaffolds for brickwork, plastering, M & E works, architectural works and repair works.
- e) Scaffold for loading platform.

### **13.5 Legal requirements**

- a) FMA (BOWEC) Regulation 1986, Part X

### **13.6 Design (PE)**

- a) Employer should provide scaffold design and drawing before started any erection of scaffold.
- b) Exact scaffold location.
- c) PE drawing should be signed and approved by registered professional engineer.
- d) PE drawing must be kept for future reference.
- e) Every metal tube scaffold and every other scaffold shall be constructed in accordance with the design and drawings of a professional Engineer.
- f) All scaffold and their support shall be capable of supporting the load they are designed to carry with a safety factor of at least hour.

### **13.7 Material Inspection**

- a) Scaffold materials must checked, approved and endorse by CIDB.(Perakuan Pendaftaran Standard)
- b) Materials test report to be kept on site for future references.
- c) Visual inspection must be done by competent person before carry out any scaffold erection.

### **13.8 Installation**

- a) Short briefing regarding scaffold installation.
- b) Permit to work (PTW) must be applied before start working.
- c) All material must be inspect visually by competent person to avoid any defect.
- d) Preparation of scaffold components.
- e) Work area must be barricade before start working.
- f) Worker must wearing PPE such as safety harness, safety helmet, safety shoes and reflector vest and tool used inspected before start working.

### 13.9 Inspection

- a) Inspection should be done after the erection work have been completed to ensure;
  - i. Sufficient of planks or metal deck as a working platform.
  - ii. Foot tie, ledger and transom were installed.
  - iii. Brace member installed to ensure stability (cross brace, diagonal brace, sway brace and plan brace).
  - iv. Tie back or outriggers were installed.
  - v. Foundation for scaffolding must strong enough to withstand the load
  - vi. Scaffold components in good condition.
  - vii. Comply with design or PE drawing endorsements.
  - viii. Access or egress.

### 13.10 Procedure

#### 13.10.1 Erection

- a) The procedure for erection should be such that an unstable condition is not reached at any time disregarding the height of the scaffolds.
- b) When built into an assembly, other than one requiring curved members, the erection tolerances given in Table A should not be exceeded. However in some instances, such as hoist toward, tighter tolerances may be required and should be used in preference to those below.

Feature	Erection Tolerance
Standards	Vertical to within $\pm 20$ mm in 1.7m length
Bay length and width	$\pm 200$ mm on the designated height Level to within $\pm 20$ mm in 2m; $\pm 25$ mm in 2.5m (subject to a max. total deviation of 50mm in total bay length)*
Lift height	$\pm 150$ mm on the designated height
Nodes	$\leq 150$ mm between coupler center
Toe Board	$\pm 150$ mm on the designated height
Mid-rail	$\pm 600$ mm on the designated height
Top-rail	$\pm 1100$ mm on the designated height

\*

Foot ties may follow the general slope of the ground on which the scaffold is founded.

- a) The ties for the scaffold should be fixed in place as the erected and reaches each tie position.
- b) Single lift putlog scaffolds may be in use for bricklaying when the wall has not reached sufficient height to give an effective tie point. In this case, the scaffold should be stabilized by outrigger and rakers if necessary, foot ties to them, until ties can be inserted in the wall.
- c) No portion of the scaffold should be used unless that portion is fully decked, braced and tied. Warning notices should be fixed to draw attention to those parts of a scaffold to those parts of a scaffold which are incomplete and should not be used.
- d) The scaffold erector shall attend scaffold training course as per “Perkeliling Ketua Pengarah Bilangan 2 Tahun 2018, Tugas dan Kewajipan Pengadali Perancah dan Pemasangan Perancah.”
- e) Scaffold competent person shall closed monitor during the erection

#### **13.10.2 Modification**

- a) All modifications to existing scaffolds should be carried out in such a way that the stability of the scaffold is not impaired. Supplementary components should be added before those that have to be removed are uncoupled and taken away.
- b) If access ways through scaffolds are required, the number of standards removed should be as few as possible and these should be replaced on either side of the gap so the total number of standards is not reduced.
- c) The ledger across the top of the gap should be further supported either by a ‘V’ frame or an ‘A’ frame of scaffolding tubes above it, transferring the loading over it to the standards at the sides of the gap. Bracing should be inserted across the top corners of the gap if extra support to the ledgers is required.

### 13.10.3 Dismantling

- a) During dismantling, no component that endangers the stability of the remaining structure should be removed. Application of dismantling of scaffold permit must be done before commencing the work. **(Refer to Appendix for example)**
- b) If dismantling has reached the stage at which a critical member has to be removed, e.g. a tie or a brace, the stability of the structure should be assured by fixing a similar or otherwise adequate member in place lower down before the member to be taken out is removed.
- c) Because of the changes that are made in a scaffolding structure during its working life, it is not safe to assume that dismantling can be carried out in the reverse order to the erection. The scaffold especially its tying and bracing, should be inspected prior to dismantling.
- d) If the scaffold is defective, it should be made good before dismantling commences.
- e) The procedure of dismantling should be orderly and planned and should proceed generally from the top in horizontal sections.
- f) Scaffolds should not be dismantled in vertical sections from one end towards the other especially in cases where a hoist tower, which apparently gives support to the scaffold, is to be left standing, unless special consideration is given to ties and bracing.
- g) The following precautions should be observed:
  - i. DO NOT remove all the ties.
  - ii. DO NOT remove the entire bracing first.
  - iii. DO NOT remove the intermediate and board end transoms.
  - iv. DO NOT remove all intermediate guardrails.
- h) An access scaffold may have been temporarily stabilized during construction by rakers that have been subsequently removed. If the level of the lowest tie point is high, e.g. over entrance halls or above tall shop windows, temporary rakers, or other structurally adequate means of support should be built up from the ground to achieve stability of the part-dismantled scaffold.

#### **13.10.4 Lowering Materials**

- a) Materials should be lowered to the ground and not stored on the scaffold. In the case where a pavement is not to be obstructed and scaffolding materials have to be stored on the lowest lift awaiting collection, this lift should be stiffened and fully braced or propped by rakers using materials recovered from the upper lifts.
- b) Components should not be thrown on the ground; they should be lowered from hand to hand in an orderly fashion or brought down by crane, gin wheel or other suitable means.

#### **13.10.5 Progressive Dismantling**

- a) Scaffolds that are to be progressively dismantled during the demolition of a building should not be left projecting above the residual height of the walls more than it is necessary.
- b) Stabilizing ties should be maintained. Scaffolds that are to remain in use while partly dismantled should be fitted with end guardrails and toe-boards at the end of the portion in use.
- c) If access is possible on to a partly dismantled scaffold, warning notices should be posted.

#### **13.11 Duties of Scaffolds Erector**

##### **13.11.1 General**

- a) Persons directly responsible for, and working on or employing persons to work on scaffolds should familiarize themselves with the contents of the relevant standards and codes of practice, and the relevant mandatory requirements.
- b) It should be ensured that the lower portions of the scaffold are adequately protected against damage through interference, accident, traffic or any other cause.

##### **13.11.2 Scaffolding Contractors**

- a) Persons constructing scaffolds should ensure that at the time of handing over to the user, it is adequate for the purpose for which it is intended and that it is stable and in safe condition.

- b) Persons constructing any type of scaffolds should employ people with the necessary experience and competence to erect scaffolds of that type.

### **13.11.3 Training**

- a) Scaffold erector shall attend training course of construct, install, modified and dismantle of scaffold from scaffold training centre that recognized by DOSH
- b)
- c) It is mandatory that scaffold erectors and scaffold competent person have passed any examination and obtained valid certificate of the course.
- d) The scaffold erector must be appoint by employer and supervise by Scaffold competent person

### **13.11.4 Communication**

- a) In modern construction works, the segregation of the specialist occupations from each other requires a high degree of co-operation which should be maintained between all concerned to avoid the creation of hazards and the consequences thereof.
- b) Any special requirements by the user should be included in a briefing to the scaffolds contractor.

## **13.12 Protection**

### **13.12.1 General**

- a) Persons using scaffolds and particularly subsequent users should ensure that the scaffolds are properly constructed and suitable for the purpose.
- b) They should ensure that the scaffolds are maintained in the relevant condition throughout their use. It is essential that they should not interfere with the scaffolding structure or platforms or ties or braces in any way whilst using it and should not leave it in a hazardous condition for others to use.
- c) They should ensure that all the necessary safeguards have been provided and maintained.

### **13.12.2 Inspection**

- a) Attention is drawn to the user's obligation to ensure that inspections are made.

### **13.12.3 Loading**

- a) Using of the scaffold should be aware of loading capacity and see that it is not overloaded. It is preferable to distribute materials adjacent to the scaffolding standards.
- b) It is recommended that users should specify a loading tower, or specially strengthened portion of the scaffold, to receive loads which are placed by mechanical handling equipment or consist of packaged materials.
- c) Persons using scaffolds on which loads are to be so placed should ensure that the scaffold is not overloaded, either locally or in general, by excessive imposed load.

### **13.12.4 Protection of the Public**

- a) Scaffolds are frequently erected in areas to which members of the public has access, such as streets, courtyards, halls and gardens.
- b) The precautions which need to be taken to protect the public during the erection, modification and dismantling of scaffolds are similar to those which need to be taken to protect other workpeople on an enclosed site.
- c) As the public is unfamiliar with the dangers and thus a higher standards of physical protection and more effective systems of work and supervision is needed.
- d) During erection, modification and dismantling, care should be taken to exclude the public from the area of the work and a sufficient area around the work.
- e) Effective steps should be taken to prevent persons being struck by falling objects or scaffold elements. Suitable brick guards, façade nets, sheeting or fans are necessary.
- f) In general, care should be taken that, at the lower levels of a completed scaffold, there are no protruding tubes, low headroom, etc. that could cause damage or injury to members of the general public or their property, e.g. clothing.
- g) Where access through parts of the base of a scaffolding structure might prove hazardous, entrance to such areas should be barred by means of a horizontal tube or other suitable obstruction.

### **13.12.5 Lightning protection for scaffold**

- a) Where metal scaffold is readily accessible to the general public, particularly when it is erected over and on part of the common highway, it should be efficiently bonded to earth.
- b) A simple method of bonding such structures consists of running a strip of metal (other than aluminium) 20mm X 3mm in size, underneath and in contact with the base plates carrying the standards of the scaffold and earthing it at intervals not exceeding 30m.

### **13.13 Inspection of Scaffolds**

#### **13.13.1 Compliance with Statutory Regulations**

- a) When completed, scaffolds should be in a condition suitable to perform the duty for which they were intended and they should comply with the statutory requirements.
- b) Scaffold should be inspected by the constructor before they are handed over for use. The user should inspect them weekly to see that they remain in compliance with the statutory regulations and should sign the reports of weekly inspection to record his findings.
- c) When equipment other than scaffolding materials are attached to the scaffold, which is subject to statutory inspections, this equipment should be inspected and the appropriate certification made.
- d) Such additional inspections may include the followings:
  - i. Lighting;
  - ii. Lifting gear and lifting appliances;
  - iii. Electrical supplies;
  - iv. Hoist ways;
  - v. Ropes.
- e) Day of inspection with scaffolding after 7 days of first inspection.
- f) Bad weather condition (need to do inspection of scaffolding)
- g) After modification and alteration.

- h) Scaffold inspection checklists must be signed by designated person.
  
- i) Scaffold tagging system must be display within vicinity area.
  - i. **Red** for unsafe for use.
  - ii. **Yellow** for under modification or alteration.(unsafe for use)
  - iii. **Green** for safe for use.
- j) The inspection should ascertain what duties to be carried out from the working platforms. He should then assure himself that the scaffold is properly constructed, that it is the right type for the planned duty, that it is of the correct height, width and length and that the working platforms are correctly positioned.
- k) He should check that these working platforms comply with the various requirements of the statutory regulations and the recommendation of this code and that access and egress are suitable and safe.
- l) He should then satisfy himself that the foundations are adequate, that they are not likely to be disturbed and that they and the lower portion of the scaffold are not liable to damage by interference, accident, traffic or any other cause.
- m) He should then check that the scaffold is sufficiently strongly designed and well enough constructed to carry the loads and that it is correctly tied, anchored and braced to have and maintain stability under load and environmental influences.
- n) He should see that it complies with the requirements of the local authority for lighting, hoarding and fenders and in general that it is not constructed in a way which can cause damage or injury to persons near the base of it by protruding tubes, low head room etc.
- o) He should see that attachments such as fans, loading bays, hoists and hoist towers and lifting tackle are properly constructed and in compliance with the statutory regulations.

### **13.13.2 Mobile Scaffold Towers**

- a) All mobile scaffold towers are to be erected in accordance with the manufacturer's instruction and shall be inspected by site engineer prior to any use on site. Additionally, all towers are to be erected complete with access ladder, safety rails and kick boards whatever the height. Mobile access scaffolds are to be included in the weekly inspection of scaffolds and the results of the inspection entered into the scaffold register.

### **13.13.3 Checklist on Scaffolds**

- a) A scaffold in use shall be inspected at least every seven days and at other times in certain circumstances, see 'Inspection of Scaffolds' of the Factories & Machinery Act 139 (BOWEC) Regulations 85. Checks should also be carried out to ensure the scaffolds are properly stored, constructed and dismantled

### **13.13.4 Maintenance**

- a) Maintain good housekeeping of scaffolding material.
- b) End user should inform designated person if found any unsafe condition for further action.

### **13.14 Hazard**

- a) Workers fall from heights.
- b) Scaffold collapse.
- c) Tripping hazard.
- d) Falling objects.

### **13.15 Control Measure**

- a) Scaffold must inspect by competent person.
- b) Practice good housekeeping.
- c) Proper materials handling and barricade working area.(2m radius)
- d) Safety harness must be worn and hook at the strong point when working at heights. (**refer to Chapter 15: Fall Protection and Working at Height**)



Access to workplace



Access to workplace



Cantilever bracket



Material loading platform



Hard barricade for edges protection



Additionally provided outrigger support



Provided platforms for every levels



Provided platforms for scaffold



Installed horizontal bracing for scaffold



Provided platforms for scaffold



Scaffold access and egress



Cantilever supports for scaffold



Side view of Cantilever supports for scaffold



Cantilever supports for scaffold



Access scaffold for car-park roof.



Dismantled cantilever scaffold and install safety railing.



Access scaffold tagged.



External scaffold on 1<sup>st</sup> level tagged



Cantilever external scaffold tagged.

# APPENDIX 1



**GIANT LEAP CONSTRUCTION SDN BHD**

## Dismantling of Scaffold Permit

This permit can be obtained from GIANT LEAP Safety Department.		Ref no.:		
This permit is valid from the time of approval. Application must be submitted at least one day in advance.				
<b>PART 1: Application – to be completed by Sub-Contractor</b>				
Work Performed by :		(name of Sub-Contractor)		
Name of Supervisor :		Signature:		
Number of worker:				
Location(s):		(Sketch Attach)		
Date of Work:		Duration of Work:	From:	To:
Safety Requirements to be complied with Prior Application of permit:				
<ul style="list-style-type: none"> <li>€ All the workers involved in dismantling are provided with safety harness.</li> <li>€ Ensure all workers wear safety harness and hook accordingly</li> <li>€ Dismantled component lower down by rope.</li> <li>€ No loose materials left unattended on the platform</li> <li>€ Debris are to be cleaned before removal of safety net.</li> <li>€ Dismantle tie-back lift by lift from top to down</li> <li>€ Stack material away from passageway</li> </ul>		<ul style="list-style-type: none"> <li>€ Barricade the affected area directly below adequately.</li> <li>€ Tethering lifeline provided to attach and hook safety harness for workers on topmost platform.</li> <li>€ Loose materials such as; clips to contained in sack and lowered down.</li> <li>€ Removal of cantilever bracket shall comply stipulated safe work procedure</li> <li>€ Applied stipulated control measures as per risk assessment.</li> </ul>		
State the type of scaffold intended to dismantle:		Requested by:		
		Name:		
		Signature:		
		Date / Time:		
<b>PART 2: Acknowledgement By – GIANT LEAP Scaffold Person</b>		<b>PART 4: Approval By – GIANT LEAP Area Manager</b>		
Acknowledge work to be done Comments:_____		The above mentioned work is APPROVED / NOT APPROVED		
Name / Signature		Name / Signature		Date / Time
Date / Time				
<b>PART 3: Checking By – GIANT LEAP Safety Dept.</b>				
Ensure all the safety provisions/requirements in PART 1 are fulfilled.				
Others:				
Name:		Signature:		Date / Time:
<b>PART 5: Notification of Completion of Work by Sub-Contractor</b>				
The above work was completed on:			Date / Time:	
Name:		Signature:		Date / Time:
*Delete where applicable. Applicant must copy and distribute this permit after part 4 is completed.				
ALL THE APPROPRIATE SIGNATURES MUST BE OBTAINED BEFORE WORK STARTS.				

# **CHAPTER 14**

## **CONCRETE WORK**

## Chapter 14 Concrete Work

### 14.1 Introduction

Concrete is a very strong and versatile moldable construction material. It consists of cement, sand and aggregate (e.g., gravel or crushed rock) mixed with water. The cement and water form a paste or gel which coats the sand and aggregate. When the cement has chemically reacted with the water (hydrated), it hardens and binds the whole mix together. The initial hardening reaction usually occurs within a few hours. It takes some weeks for concrete to reach full hardness and strength. Concrete can continue to harden and gain strength over many years.

### 14.2 Objective

The objectives of this chapter are:

- a) Understand the work flow of concreting.
- b) Determine the hazard when doing concrete work.
- c) Control measure for the hazard that exposed to the workers.
- d) Ensure safety, health and welfare of the workers.

### 14.3 Definition

- a) **Concrete** – A mixture of cement, sand and aggregate.
- b) **Accelerator** - Chemical use to speed up the hydration (hardening) process of concrete.
- c) **Formwork** – temporary or permanent moulds into which concrete or similar materials are poured.
- d) **Falsework** – temporary structures used in construction to support spanning or arched structures in order to hold the component in place until its construction is sufficiently advanced to support itself.
- e) **Industrialised Building System (IBS)** – term used in Malaysia for a technique of construction where by components are manufactured in a controlled environment, either at site or off site, placed and assembled into construction works. Worldwide, IBS is also known as Pre-fabricated/Pre-fab Construction, Modern Method of Construction (MMC) and Off-site Construction
- f) **Precast concrete** – construction product produced by casting concrete in a reusable mould or "form" which is then cured in a controlled environment, transported to the construction site and lifted into place (tilt up). In contrast, standard concrete is poured into site-specific forms and cured on site

- g) Aluminium formwork system** – construction system for forming cast using aluminium in place concrete structure of a building. It is also a system for scheduling and controlling the work of other construction trades such as steel reinforcement, concrete placement and mechanical and electrical conduits.
- h) Formwork Supervisor** – person who already trained and have experience of formwork related matters

#### **14.4 Legal Requirement**

- a) Occupational Safety and Health Act 514:
  - i. Section 15 : General duties of employers and self-employed person to their employees.
- b) Section 24 : General duties of employees
- c) Regulation 2000 :Use and standards of exposure of chemicals hazardous to health (USECHH)

#### **Factory and Machinery Act 139:**

- a) Safety Health and Welfare Regulation 1970
  - i. Regulation 6 : Floor
  - ii. Regulation 7 : Access to workplace
  - iii. Regulation 8 : Opening generally to be fence
  - iv. Regulation 12: Working at height
  - v. Regulation 23: Cleanliness
  - vi. Regulation 32: Working cloth, personal protective clothing
  - vii. Regulation 36: Washing facilities
- b) Mineral Dust Regulation 1989
- c) Building Operations and Works of Engineering Construction 1986
  - i. Regulation 10 : Access to workplace
  - ii. Regulation 11 : Dust and gases
  - iii. Regulation 12 : Corrosive substance
  - iv. Regulation 15 : Protective apparel
  - v. Regulation 18 : Public vehicular traffic
  - vi. Regulation 19 : Stability of structure
  - vii. Regulation 22 : Disposal of debris
  - viii. Regulation 23 : Numbering and marking of floors
  - ix. Part III : Concrete work
  - x. Part IV : Structural steel and precast concrete assembly.

## **14.5 Type**

There are many type of concreting work use in construction industries.

- a) Industrialise Building System (IBS)
- b) Conventional cast using woods.
- c) Pre-cast
- d) Aluminium cast

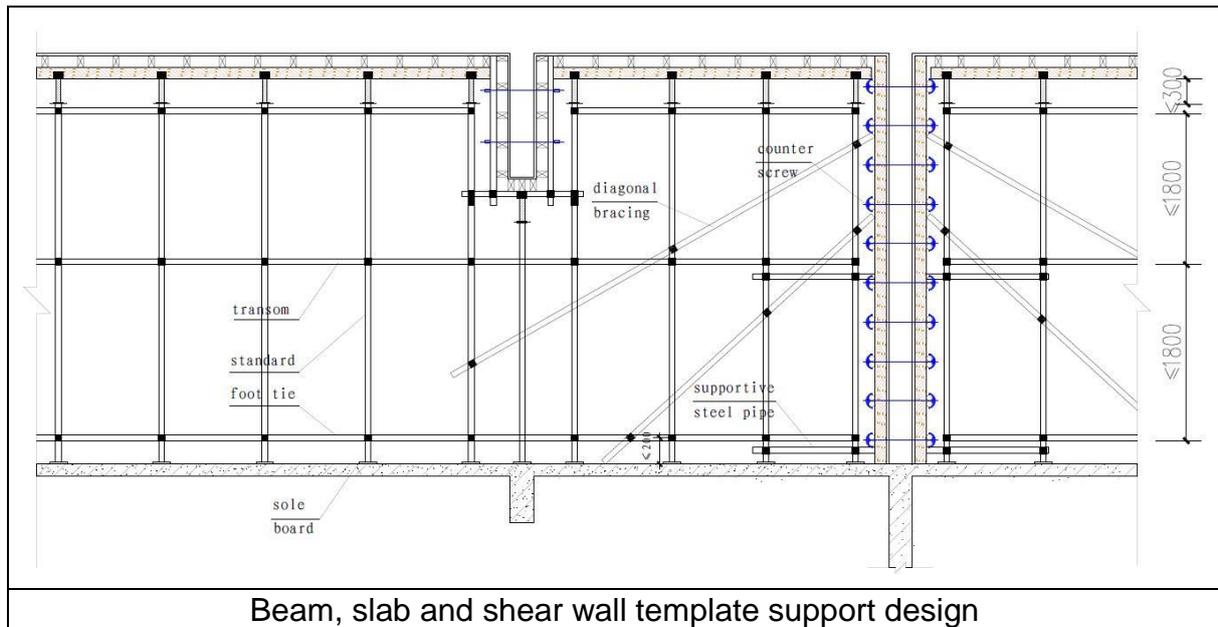
## **14.6 Procedure**

### **14.6.1 Formwork and Falsework**

Formwork is the term used for the process of creating a temporary mould into which concrete is poured and formed. Traditional formwork is fabricated using timber, but it can also be constructed from steel, glass fibre reinforced plastics and other materials. While formwork is a broad term that is used in relation to the forming process using a wide variety of materials, shuttering is a term that is often used to refer to the process of using plywood to form the mould. All kinds of construction projects are likely to employ formwork and shuttering techniques.

The following requirements should be satisfied by good formwork:

- a) Strong enough to withstand dead and live loads.
- b) Capable of retaining its shape by being efficiently propped and braced horizontally and vertically.
- c) Joints should prevent leakage of cement grout.
- d) Should be capable of being removed in various parts without damaging the concrete.
- e) Material used be suitable for reuse.
- f) Should be set accurately to the desired line.
- g) As lightweight as possible.
- h) Material should not warp or distort on exposure to the elements.
- i) Should rest on a firm base.



#### 14.6.1.1 Planning

Formwork used and designed for cast-in-place concrete requires special considerations. Due to the significant weight that concrete adds to formwork and shoring equipment, it is important to check that eccentric loads are located over members that have been designed for such loading. If single-post shores are used one on top of another (tiered), then additional shoring requirements must be met. The shores must be:

- a) Designed by a qualified designer and the erected shoring must be inspected by an engineer qualified in structural design.
- b) Vertically aligned.
- c) Spliced to prevent misalignment.
- d) Adequately braced in two mutually perpendicular directions at the splicing level.

Adjustment of single-post shores to raise formwork must not be made after the placement of concrete. Reshoring must be erected, as the original forms and shores are removed, whenever the concrete is required to support loads in excess of its capacity.

### **14.6.1.2 Materials**

- a) All materials and equipment used in formwork construction must be fit for the intended purpose and meet design specifications.
- b) Materials and equipment must be designed to conform to relevant Malaysian Standards.
- c) Where material is designed to an international or other standard, an engineer must certify that it conforms to the relevant Malaysian Standard.
- d) Materials and equipment must also be manufactured in accordance with a quality assurance system that ensures compliance with the design specification.
- e) A suitable system must be implemented to ensure that only materials and components that comply with the specifications of the formwork design drawings and documentation are being used.
- f) Materials and components that are damaged, excessively worn or not fit for the intended use must not be used.
- g) Evidence must be kept on site, which verifies that formally sheets conform to Malaysian Standards.
- h) materials must checked, approved and endorse by CIDB.(Perakuan Pendaftaran Standard)

### **14.6.1.3 Safe Work Method Statement**

A safe work method statement (SWMS) must be prepared for high risk construction work before the work starts. A range of activities defined as high risk construction work may be carried out including work:

- a) Involving a risk of a person falling more than 2 metres
- b) Involving demolition of an element of a structure that is load-bearing or otherwise related to the physical integrity of the structure
- c) Involving or likely to involve the disturbance of asbestos
- d) Involving structural alterations or repairs that require temporary support to prevent collapse
- e) Carried out in or near a shaft or trench with an excavated depth greater than 1.5 metres or a tunnel
- f) Involving the use of explosives
- g) Carried out on or near energised electrical installations or services
- h) Carried out in an area that may have a contaminated or flammable atmosphere
- i) Involving tilt-up or precast concrete
- j) Carried out on, in or adjacent to a road, railway, shipping lane or other traffic corridor that is in use by traffic other than pedestrians
- k) Carried out at a workplace in which there is movement of powered mobile plant
- l) Carried out in an area in which there are artificial extremes of temperature

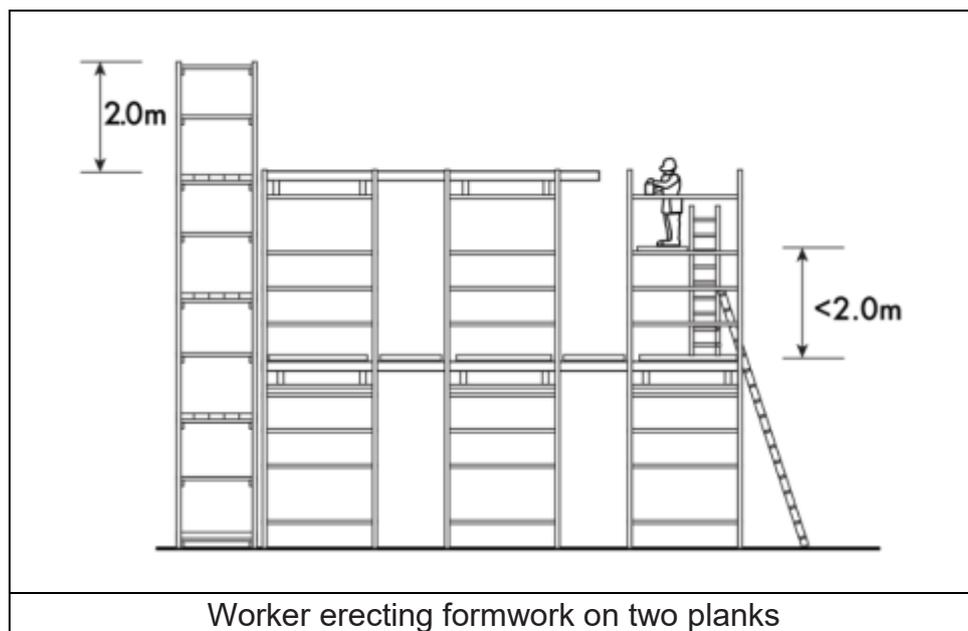
The SWMS must:

- i. Identify the type of high risk construction work being done
- ii. Specify the health and safety hazards and risks arising from the work
- iii. Describe how the risks will be controlled
- iv. Describe how the control measures will be implemented, monitored and reviewed.

A SWMS must be developed in consultation with workers and their representatives who are carrying out the high risk work.

#### 14.6.1.4 Erection of Formwork

Formwork must be erected systematically and tied in and/or braced progressively to stabilize the structure. Where a person is to install joists from underneath, the vertical distance between the formwork deck and the false deck can be increased. This is illustrated in diagram below.



- a) Formwork must be erected on a stable base to prevent the risk of collapse. Suspended slabs must be able to safely support loads that may be applied by the concrete pour, workers and crane lifted loads.
- b) Base plates must be provided under props and standards on formwork frames unless the prop or standard has an integral foot or an engineer documents that a base plate is unnecessary.
- c) Sole boards designed to suit the ground conditions should also be used under props and standards on natural ground, unless an engineer states otherwise.

- d) Frames and props must be located on a firm base, which is ground that will not subside, fail or get washed away.
- e) Persons erecting formwork frames must be trained in their safe erection.
- f) Formwork frames must be erected in a progressive manner to ensure both the installers safety and the stability of the overall structure. Braces must be attached to the frames as soon as practical.
- g) The risk of a fall can exist on edges of formwork frames during their erection. In this situation, it is necessary to install edge protection on the frames as they are erected.
- h) Provided the side bracing (or other edge protection) is installed progressively and as soon as enough material has been raised up additional control measures to prevent a fall occurring do not have to be provided.
- i) Many conventional formwork frames consist of diagonal braces that cross in the middle.
- j) While these braces are not considered to be suitable edge protection for a completed formwork deck, they may provide reasonable fall protection during frame erection. This is only the case where braces are installed in a progressive manner as soon as the braces are handed up to a person.
- k) As the height of formwork frames increase, there is a greater need to provide lateral stability to the frames. All framing must be carried out so that it complies with on site design documentation and any manufacturers' requirements.
- l) Do not deviate from layout drawings when erecting formwork without the approval of a qualified designer.
- m) Be certain that all wall ties are in place and secured as per manufacturer's recommendations. Do not weld, bend or otherwise alter wall ties as it may seriously reduce their strength.
- n) Adequate temporary bracing must be in place while initially setting formwork. Assure that formwork is properly braced and stabilized against wind and other external forces.
- o) Safe working platforms must be installed as per applicable safety standards and as stated in Section 5 herein.
- p) When gang forming, lifting devices must be properly spaced and securely attached as per manufacturer's recommendations. Rigging must be arranged so that any one lifting bracket is not overloaded and that lifting cables are not at excessive angles, which will reduce allowable loads. Spreader beams with load equalizers are recommended for all but simple two point lifts. Follow manufacturer's/suppliers recommended procedures concerning capacity and use of lifting hardware and crane.
- q) A minimum of two tag lines must be used to control movement of crane-handled formwork. Do not allow personnel on or directly under any gang form while it is being moved or suspended in air.

- r) Do not erect gang forms when jobsite wind conditions prevent safe manoeuvring of gangs. Assure that all rigging connections are properly made in accordance with safe practices and procedures.
- s) Formwork should be adequately braced, anchored, or otherwise secured prior to releasing lifting mechanism.
- t) Wall forms must not be erected so as to support deck concrete loading unless the wall forms are a designed part of the deck support system.
- u) Formwork supervisor must supervise During erection of falsework,



Shear wall template support



Split bolt wearing a PVC tube



Rectangular column template  
support

#### **14.6.1.5 Bracing**

- a) Aligners (alignment devices, plumbing struts) are considered only as alignment devices with no provisions for withstanding concrete pressure or any portion thereof. Maintain forms plumb during pour to ensure that aligners are not supporting or stabilizing concrete pressures.
- b) Braces used to withstand concrete pressure must be designed by a qualified formwork designer.
- c) Unless specified, wind loading and other external lateral loads are not considered in the manufacturer's layout drawings.
- d) The adequacy of stakes, dead-men, sills, anchor-bolts, etc., must be determined to assure safe support of the imposed brace loads. The
- e) Responsibility for adequate anchorage of braces should be assigned only to those personnel with sufficient experience to assure sound judgement.
- f) Before removing braces, assure that the concrete has attained sufficient strength to safely support the imposed load at support locations.
- g) Do not exceed the rated load of the braces.
- h) Inspect installed braces immediately after installation for correctness of spacing and proper attachment device.



Aluminium formwork bracing

#### **14.6.1.6 Walkway System**

- a) All walkway systems must be properly positioned, spaced and fastened as per manufacturer's specifications and all applicable safety regulations.
- b) Walkway systems must be in place along the upper level of formwork. Workers must never attempt to walk or stand on top of forms.
- c) Scaffold brackets must be attached with the manufacturer's recommended connectors. Never use substitutes or make-shift devices. Never hang brackets from wall ties after removal of forms.
- d) All walkway platforms must utilize at least two (2) planks laid side by side, and must overlap their support ledger by not less than 6 inches. Unsupported ends of scaffold planks must not project more than 12 inches past their support ledger.
- e) Scaffold planks must be minimum 2 inch x 10 inch nominal lumber and must be scaffold grade as recognized by approved grading rules for the species of lumber used, or must be of materials having equivalent or greater strength. Scaffold planks must safely support a minimum of 25 pounds per square foot over a maximum span of 8 feet. **(refer to Chapter 13 Scaffold)**
- f) When deemed appropriate by the competent person, scaffold planks must be nailed and clinched, bolted or otherwise positively secured against dislodgement from effects of wind, weather, gang form lifting operations or the like. Bolt heads and nails must be driven flush with tops of planks to prevent tripping hazards.

- g) All scaffold bracket platforms must be equipped with guardrails, mid-rails and toe-boards along all open sides and ends and be maintained secure and in good condition at all times. Guardrails must be of at least 2 x 4 nominal sized lumber, with minimum 1 x 6 or 2 x 4 nominal mid-rails, with toe-boards at least 4 inches high, supported by 2 x 4 nominal lumber uprights spaced not more than 8 feet apart, or must be of other materials providing equivalent or greater strength and protection. **(refer to Chapter 15 Fall Protection and Working at Height)**
- h) Maximum spacing between scaffold brackets is eight feet. Never exceed this distance unless the walkway system has been specifically designed for a greater distance. Follow manufacturer's recommendations as to loading and spacing of scaffold brackets. Unless designed otherwise, scaffold brackets are designed to support a maximum load of 25 pounds per square foot when spaced on 8 foot centres. Scaffold brackets are not designed for F401 4 the additional loads imposed from stacking rebar or placing other equipment on walkways.
- i) Always brace and/or otherwise secure forms and scaffold from overturning due to attachment and use of scaffold brackets.
- j) Never allow persons to work on one level of walkways if others are working directly below or overhead unless proper protection is provided, such as safety nets.
- k) It is unsafe and unlawful for persons to occupy any form walkway while the form is being moved.
- l) Access ladders or other suitable safe methods must be used to obtain access to walkway platforms. Do not position ladders so that their weight while being used can affect the strength or stability of the scaffold and formwork.
- m) Do not use form panels as a ladder.
- n) If using walkway systems is not practical, personnel must be protected against falls by means of personal fall arrest system attached to components having adequate strength to meet or exceed applicable codes or by safety nets or other equivalent protection. Personnel protected by personal fall arrest system must exercise additional care when handling formwork.

#### **14.6.1.7 Inspection**

- a) Inspect completed formwork prior to placing concrete to assure proper placement and secure connections of ties and associated hardware. All threaded connectors, such as ties, inserts, anchor bolts, etc., must also be checked for proper thread engagement.
- b) Inspect erected form walkway systems before each use. Assure that bolts, nuts, and other connections are fastened securely.
- c) Inspect bracing attachments and form alignment after each form cycle. Inspect installed forms and braces immediately prior to pour and during pour.
- d) Formwork structure must be inspected by formwork supervisor before pouring concrete.



Formwork inspection done by engineer.

#### 14.6.2 Pouring of the Concrete

- a) The contractor must verify prior to and during concrete placing that the method of placement and rate of pour is consistent with formwork design. **DO NOT OVERLOAD FORMWORK.**
- b) Concrete must not be placed in any manner which imposes impact loads that exceed the rated capacity of the form.
- c) Instruct personnel on proper vibration. Do not use vibrator to move concrete. Do not vibrate further than one-foot into the previous lift. Avoid vibrator contact with wall ties. External vibrators must not be attached to formwork unless it was designed for their use.
- d) All materials used to make concrete such as cement, coarse aggregate, sand, and water are quite heavy even in small quantities. When lifting heavy materials, back should be straight, legs bent, and the weight between legs as close to the body as possible. Do not twists at the waist while lifting or carrying these items. **(refer to Chapter 26 Health Issue).**
- e) When working with fresh concrete, care should be taken to avoid skin irritation or chemical burns. Prolonged contact between fresh concrete and skin surfaces, eyes, and clothing may result in burns that are quite severe, including third-degree burns. If irritation persists consult a physician.
- f) Waterproof gloves, a long-sleeved shirt, and long pants should be worn. If must stand in fresh concrete while it is being placed, screeded, or floated, wear rubber boots high enough to prevent concrete from getting into them. **(refer to Chapter 21 PPE)**

- g) Waterproof pads should be used between fresh concrete surfaces and knees, elbows, hands, etc., to protect the body during finishing operations. Eyes and skin that come in contact with fresh concrete should be flushed thoroughly with clean water. Clothing that becomes saturated from contact with fresh concrete should be rinsed out promptly with clear water to prevent continued contact with skin surfaces.

### **14.6.3 Stripping Formwork**

Stripping formwork can be one of the most hazardous phases of concrete construction. While falling objects are the primary hazard, there may also be fall hazards as a result of floor collapse and manual tasks hazards from a person working in awkward postures, repetitive handling of materials and limited task variety. As with formwork erection, the stripping operation must be carried out in an orderly, progressive manner.

#### **14.6.3.1 Safe Work Method Statement**

A safe work method statement (SWMS) for the stripping operation should be prepared and provided to those who will be involved in this high risk activity. The SWMS should:

- a) Identify the work that is high risk construction work
- b) State hazards relating to the high risk construction work and risks to health and safety associated with those hazards
- c) Describe the measures to be implemented to control the risks
- d) Describe how the control measures are to be implemented, monitored and reviewed; and include:
  - i. The number of persons in the stripping crew.
  - ii. The sequence of stripping activities – this would need to detail how the frames and/or other supports should be removed (that is, how far U-heads are to be lowered).
  - iii. Whether the support system is to be completely removed in a zone prior to removal of the formwork deck or whether the supports are to be lowered slightly but still remain under the formwork while it is being removed.
  - iv. When back-propping is required or only part of the support system is to be removed, how the structural members are to remain in place and/or the type and layout of members that will replace the formwork system.

- v. Any other special requirements involved in the stripping and or building process (e.g. checking of back-propping after post-tensioning)

#### **14.6.3.2 Certification Prior to Stripping**

- a) Prior to commencement of the stripping operation, a competent person, from the principal contractor (i.e. the project engineer), is to provide written certification that formwork can be removed. This certification should be based on an engineer's specifications for the building, the strength of the concrete mix and the time period that has elapsed since the pour. An engineer will also be required to have input into the stripping safe work method statement to ensure the concrete element will not fail and must have provided details on the structural engineering drawings.
- b) Documentation from the concrete supplier verifying the concrete specification should be available on request. A concrete sampling and testing procedure should be in place to verify concrete meets its design specification.
- c) It is important to note that the compressive strength of laboratory cured test specimens may differ from the actual compressive strength due to factors such as temperature and humidity on site, poor curing techniques and the addition of water to the mix. Some builders may therefore choose to have test samples on site to give an indication of the variation between 'on site' tests and laboratory tests.

#### **14.6.3.3 Exclusion Zone**

- a) Only persons involved in the stripping operation should be permitted in the area to be stripped.
- b) The signs should require persons to keep out of the area (e.g. "Danger - Formwork stripping in progress – authorized persons only").
- c) Where other trades are required to work on the same floor during stripping of walls, columns or small sections of soffit, the principal contractor or PCBU should ensure that stringent controls are applied that prevent other persons from entering the stripping area.

#### **14.6.3.4 Drop Stripping**

'*Drop stripping*' is a term sometimes used to describe the method used when all of the formwork support system is removed and the form-ply is allowed to drop to the floor either by its own weight or by persons levering it off. In general, this method of stripping should not be used to strip formwork. It can be hazardous because the form-ply is likely to fall in an uncontrolled manner and can strike persons underneath.

However, in some situations, sheets can be dropped to the floor provided the following is ensured:

- a) The formwork support system (e.g. props or frame) is only removed from under the sheet to be dropped. Once the sheet is dropped the process progressively continues until all sheets are dropped.
- b) The person levering off the sheet is not at risk of being struck when the sheet falls to the floor keeping in mind that sheets may fall at an angle due to their large surface area and effect of the air– for example, the person does not stand directly under the sheet but stands far enough away and uses a pinch-bar to lever the sheet off. It should be noted that this method can only be used on relatively low ceiling heights unless the person can be positioned on a working platform or elevating work platform. The advantage of using a platform is that the person will generally be able to get closer to the sheet to be removed without being at risk.
- c) The formwork system and sheets are not left in a haphazard manner on the floor but are placed in stacks and progressively removed from the floor area.

#### **14.6.4 Crane and Load Handling Systems (refer to Chapter 24 Machinery and Equipment)**

Materials, including stacks of ply, forms, bearers and joists, are sometimes lifted onto a deck during formwork erection, and before the deck are signed over. Stacked materials create point loadings which the formwork structure may not be designed to bear. Materials should be stored only where and when the deck is able to bear the load.

#### **14.6.4.1 Loading Materials during Formwork Construction**

To minimize the risk of collapse and other hazards:

- a) Formwork drawings should clearly identify the maximum (pre-pour) point loadings for the deck.
- b) Point loadings should not exceed the maximum weight specified by an engineer.
- c) Crane crews should be notified when an area of deck is ready to take a load, and where that load should be placed.
- d) Crane crews should not lift materials onto the deck until there is a designated lifting zone.
- e) Loads should only be placed in the area(s) designated as safe.
- f) Loads must not be placed on the formwork deck if the formwork documentation prohibits loadings.
- g) Delivery of materials to the site should be planned so that loads are not lifted onto unsecured decks.
- h) Prior to persons leaving the site, materials and equipment should be secured to prevent them being moved by wind.

#### **14.6.4.2 Lifting Formwork Materials**

Crane-lifted loads should be slung and secured so that the load (or any part of it) cannot fall, as follows:

- a) Tare mass of wall, lift or column forms should be provided on site with formwork documentation and made available for inspection by all interested parties.
- b) Safe working load mass should be clearly marked on bins.
- c) Lifting boxes should be appropriate for the material being lifted, and be engineer-designed and certified.
- d) Four chains (one in each corner) should be fitted to lift boxes.
- e) Specifically-designed lifting boxes should be used to lift smaller components (e.g. spigots, U-heads, base plates and couplers). Boxes should have enclosed sides or robust mesh (with openings less than the minimum size of materials being lifted).
- f) Lifting boxes should be inspected and maintained, and inspection records kept.
- g) Loads within lifting boxes should be secured against movement.
- h) Materials should not be stacked higher than the side of the box unless they are adequately secured, but at no time should the box become top heavy.
- i) Formwork frames should either be strapped together or lifting slings should be wrapped around the load.
- j) Loads of joists or bearers should be strapped together before lifting.

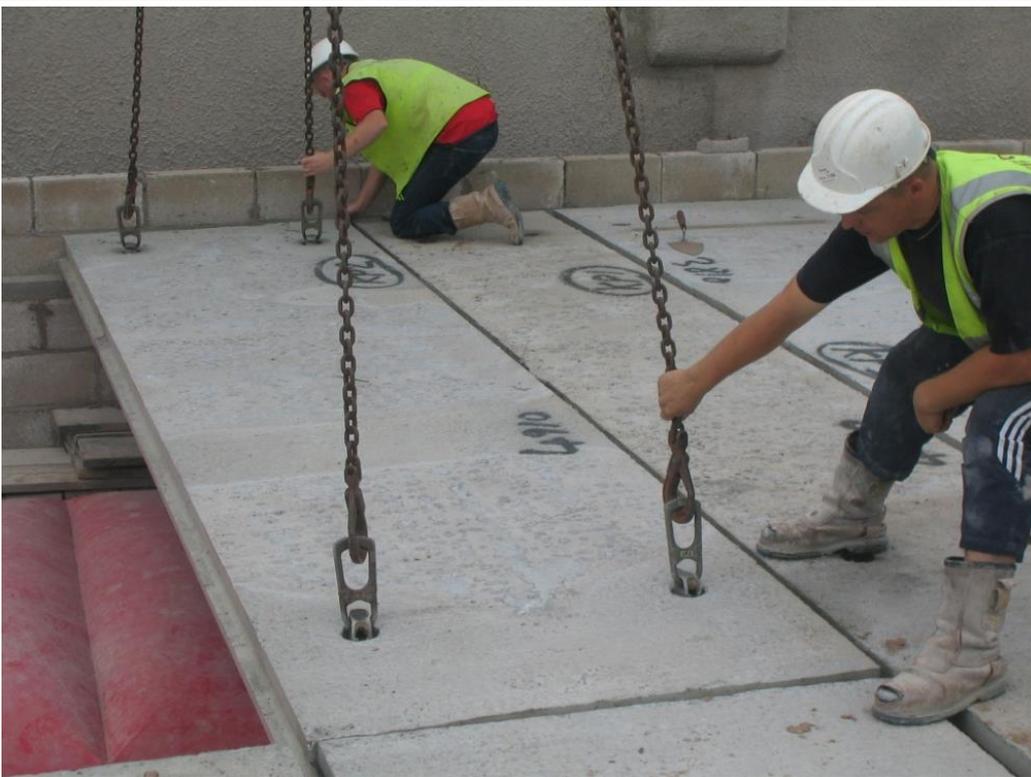
- k) Use tag lines as required to control loads and well as forms.
- l) Form-ply loads should be strapped together and lifted in a flat position.
- m) Ensure where possible all loads are supported with dunnage and the load is uniformly distributed over the supporting surface.

#### **14.6.4.3 Precast Lifting**

Wall and column forms must only be lifted with a positive lifting system such as lifting lugs or by slinging the lifting slings around the form such that the form cannot slip out of the slings. Purpose designed lifting lugs are preferable to slinging the load because there is less risk of the load becoming inadvertently disconnected from the crane hook.

When lifting wall and column forms always make sure:

- a) There is an engineer's drawing or certification for lifting the form
- b) The lifting lug type, location and attachment are the same as specified on the drawing.
- c) The types and spacing of members on the form are the same as those specified on the engineer's drawing.
- d) The numbers, types and spacing of bolts and screws on the form are the same as those specified on the engineer's drawing.
- e) The form is engineer certified for any side loading lifting (i.e. when flipping the form onto or when using multi-legged slings)
- f) Any bracing on the form is the same as that specified on the engineer's drawing.
- g) A competent person from the formwork contractor inspects the form every time it is lifted and verifies it is safe to lift.
- h) There is a documented system so the forms are inspected for damage or deterioration and remain safe.



Lifting points must be endorse by PE

It is important to:

- a) Never lift a wall or column form unless the form complies with the engineer's drawing.
- b) Never lift a form that has lifting parts that are damaged or rotten
- c) Never change the lifting points without engineer approval
- d) Never drill extra holes in the lifting parts of the form
- e) Never use bolts, screws or timbers different to those listed on the engineers drawing,
- f) Never allow suction between two members.

#### **14.6.5 Access and Egress**

Access to the form may be provided in a variety of ways including one or more of the following:

- a) Personnel and material hoists on the building
- b) Permanent stair systems in the building
- c) A trailing stair system suspended from the slip form or jump form
- d) An internal trailing ladder system

### 14.6.6 Miscellaneous

- a) All form components and/or hardware must be kept clean, and if appropriate, lubricated to insure proper performance and to allow for proper inspection.
- b) All form components must be inspected regularly for damage or excessive wear. Equipment found to be in these conditions must be replaced immediately and not re-used.
- c) Field repair of modular formwork components (other than plywood repairs) must not be undertaken without consulting the manufacturer's qualified representative.
- d) The forming layout shall be prepared or approved by a person qualified to analyse the loadings and stresses which are induced during the construction process. The layout shall be at the jobsite.
- e) Forming installation and pouring procedures must comply with safe practices and with the requirements of the law and governmental regulations, codes and ordinance.
- f) All persons who may be exposed to work health and safety risks resulting from formwork construction must be provided with information and training that is specific to the formwork system that is being used.
- g) When cutting dry concrete, exercise caution as to a possible exposure of silica. During training, help employees understand the risk of exposure to silica. There are a few suggested methods that can be utilized to help control this exposure. Using water, or the wet method, can prove effective in suppressing the amount of dust created or dust released if one is cutting into concrete or sandblasting. Another alternative is to have a ventilation system. N-95 respirators are recommended for work with silica.
- h) When possible, ensure that the truck is parked on a level surface. Parking on a slope will shift the centre of gravity of the truck and increasing the potential of a tip-over. Access should be wide enough for the truck and overhead clearance should allow for the truck to pass without danger of touching overhead lines. Never stand on the shoot.
- i) One of the great dangers posed to concrete construction workers is motorists. Those that lay cement, or form curbs and gutters, must take precautionary steps to avoid traffic-caused incidents. Clearly mark off work area and ensure that traffic is moved away from workers. Use flaggers if necessary. **(refer to Chapter 5 Traffic Management and Road Work)**
- j) Determine the appropriate path for the hose to run to the location where cement is being pumped. To limit the risk of injury, make sure that the hose has a clear pathway. Look for potential hazards such as hoses running underneath ladders and scaffolds as well as other people that could be hit or truck by the hose.

# **CHAPTER 15**

## **FALL PROTECTION AND WORKING AT HEIGHT**

## **Chapter 15 Fall Protection and Working at Height**

### **15.1 Introduction**

Unsafe condition prevailing in construction site may situate a person to fall or exposed a person to strike by objects dropping. It's important to develop standardized protection system to safeguard workers in construction site against such as hazards.

### **15.2 Objective**

To develop standardize and systematic fall protection provisions in construction site.

### **15.3 Scope**

The following procedure is applicable for working at height, protection against floor opening, building edges and object dropping from height.

### **15.4 Legal requirements**

Occupational Safety and Health Act 514:

- a) Section 15 : General duties of employers and self-employed person to their employees.
- b) Section 17 : General duties of employers and self-employed person to other than their employees
- c) Section 24: General duties of employees at work place.

Factory and Machinery Act 139:

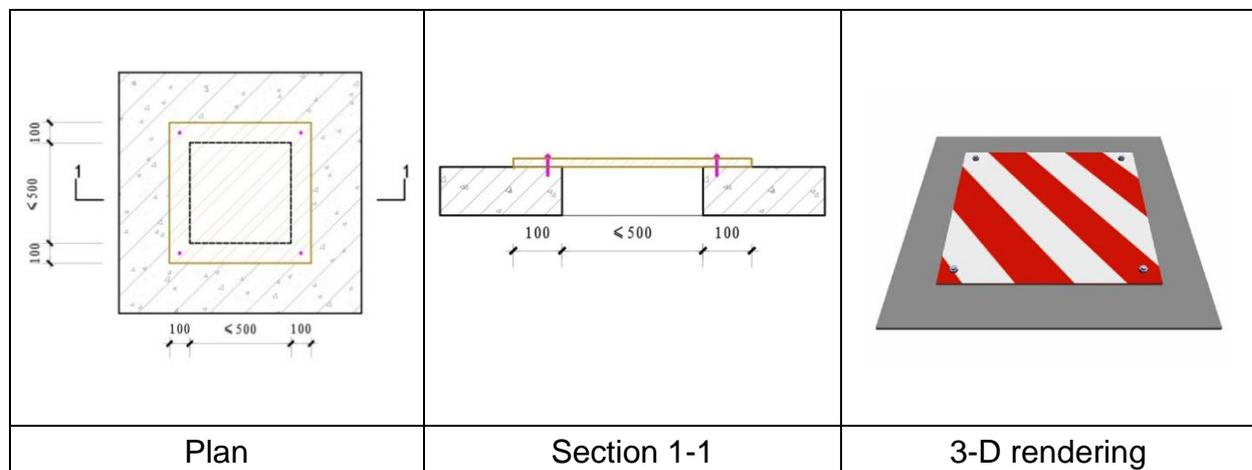
- a) Safety Health and Welfare Regulation 1970
  - i. Regulation 7 : Access to work place
  - ii. Regulation 8 : Openings generally to be fenced
  - iii. Regulation 9 : Stairway
  - iv. Regulation 10 : Fixed ladder
  - v. Regulation 12 : Working at height
- b) Building Operations and Works of Engineering Construction
  - i. Regulation 10(1) : Access to workplace
  - ii. Regulation 15(1) : Protective equipment.
  - iii. Regulation 44&45: Construction of catch platform
  - iv. Regulation 50-55 : Safety belts & Safety nets
  - v. Regulation 62-71 : Ladders and Step Ladders
- c) Guidelines for the Prevention of Falls at Work Place 2007

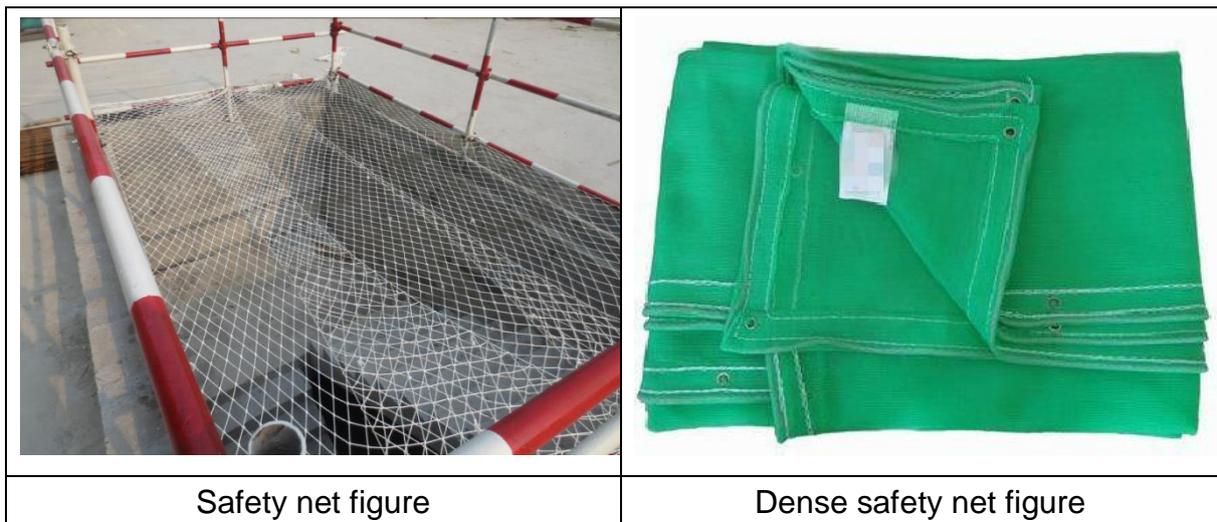
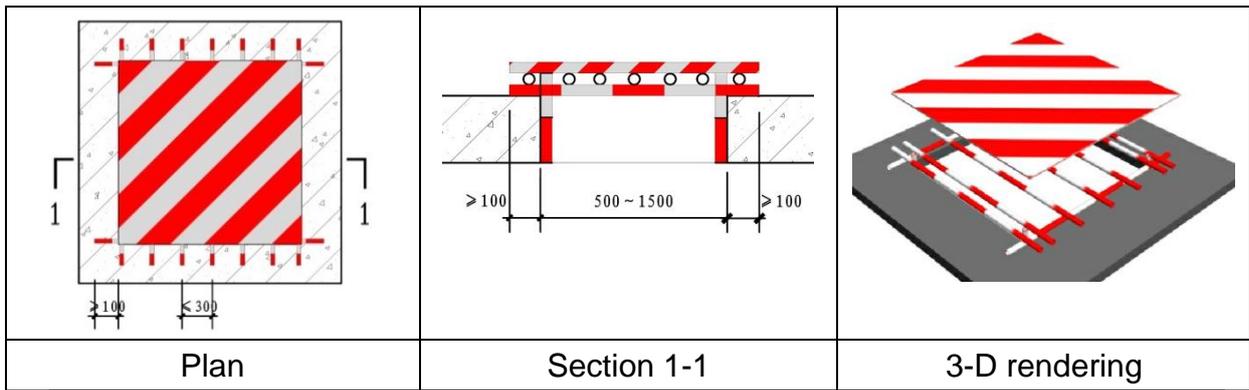
## 15.5 Procedure

### 15.5.1 Fall Protection (Refer to appendix for checklist)

#### 15.5.1.1 Floor opening protection

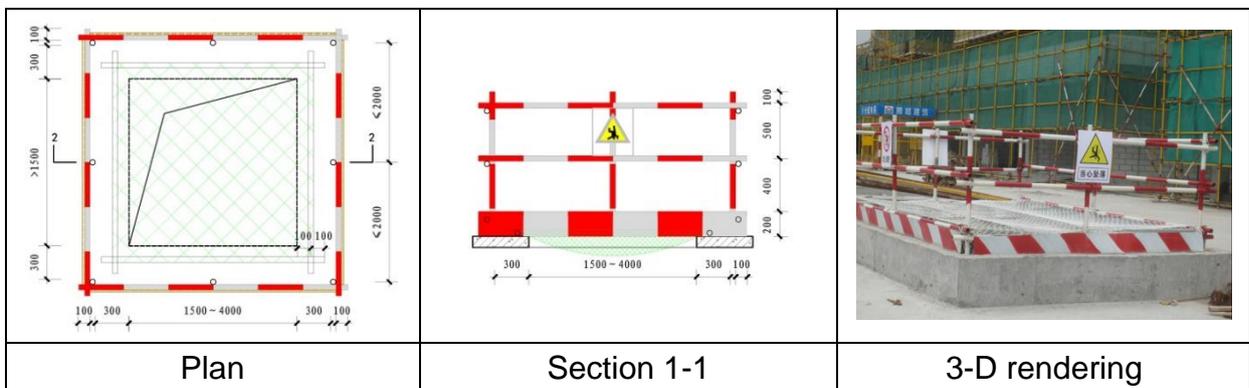
- a) The floor opening on floor surface, roof, and on other building components platform smaller than 250mm called hole, this type of floor hole use 18mm thick plywood and cover hole. The plywood shall be fixed with concrete nails.
- b) The hole opening size equal to or greater than 250mm on floor surface, roofs and other building components platform less than 1500mm, called the floor opening must cover with a solid cover. It is recommended two types methods of protection details :
  - i. Use 2 timbers run across the hole and then covered with 18mm thick plywood which fixed with iron nails to the timber runs, the surface of plywood shall painted with warning sign indicator with red and white paints (spacing 20cm, angle of 45 degrees).
  - ii. Cover the opening with 10mm thick plywood, and fixed with  $\Phi 8$ mm diameter expansion bolts or cement nails, surface painted with warning sign indicator with red and white paints (spacing 20cm, angle of 45 degrees).





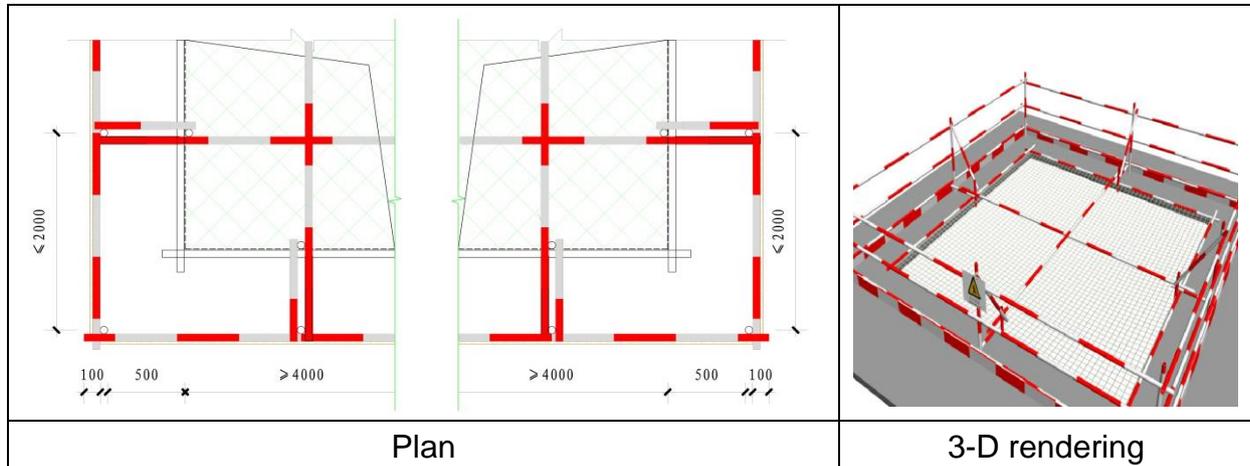
a) For protection of floor opening from 1500 ~ 4000mm as follows :

- i. Setup  $\Phi 48\text{mm}$  diameter steel pipe guard rails around the hole, pole spacing not exceeding 2000mm, lower part of the protective railing set 200mm high and 18mm thick plywood toe board, top railings at 1.1m height and middle railing at 600mm height, all components must have painted warning sign indicator with red and white (with 400mm Spacing), guard rails setup full of safety net close to the wall and display warning signboard at the top of a horizontal railing bar "beware of falling" poster signs.



b) For protection of floor opening from 4000mm ~ 5000mm as follows :

- i. Install guard rails use same type of material, same pattern of installation except that install additional guard rail in the bottom to ensure the rigidity of the guard rails.



c) For protection on floor opening with exceed 5000mm :

- i. It is relatively rare, if encountered such scene of holes, should carry out a special protection program with approval of project manager.

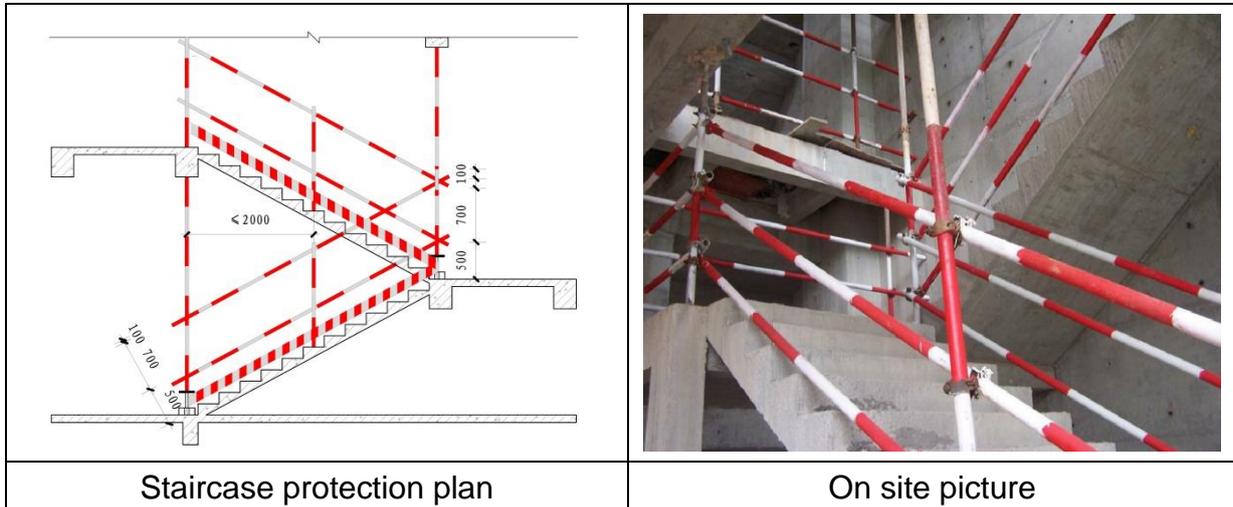
### 15.5.1.2 Excavation Edge Protection. (Refer to Chapter 9: Excavation)

a) Foundation or pile cap excavation edge protection

- i. Every excavation depth more than 2000mm must set edge protection around the excavation. The edge protection around the excavation must use steel pipe as guard rails, set of three horizontal pipe members connect with the vertical post pipes spacing not more than 2000mm, the horizontal pipe height  $\geq 700$ mm.
- ii. If the top of the foundation pit cast with concrete beam the vertical starter steel bar  $\Phi 18$ mm diameter shall be embedded, the starter steel bar anchorage allowance length is  $\geq 500$ mm).
- iii. The edge protection's horizontal pipe members, vertical pipe posts and foot plate, must brush painted red and white as warning indicator the stripe spacing shall be 400mm.
- iv. Guard rails must be setup with full of safety net and displays warning sign notice "beware of falling" warning signs shall place conspicuously easily to be seen.

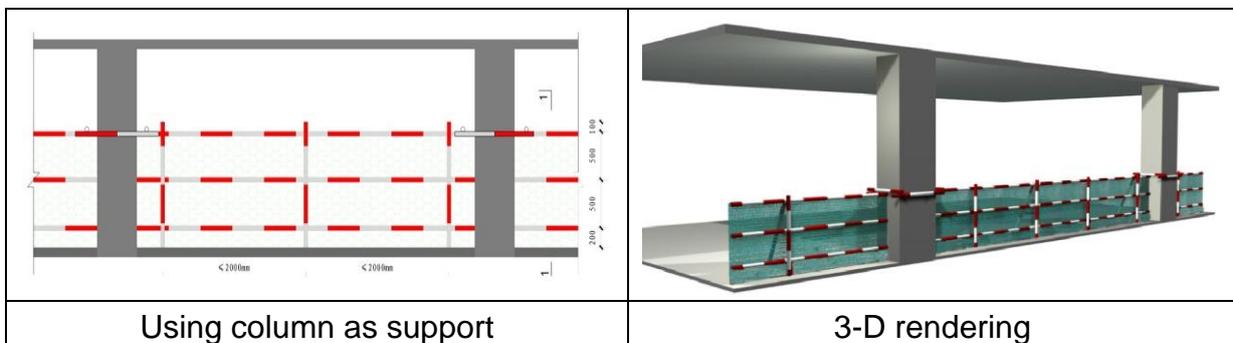
### 15.5.1.3 Staircase Edge Opening Protection

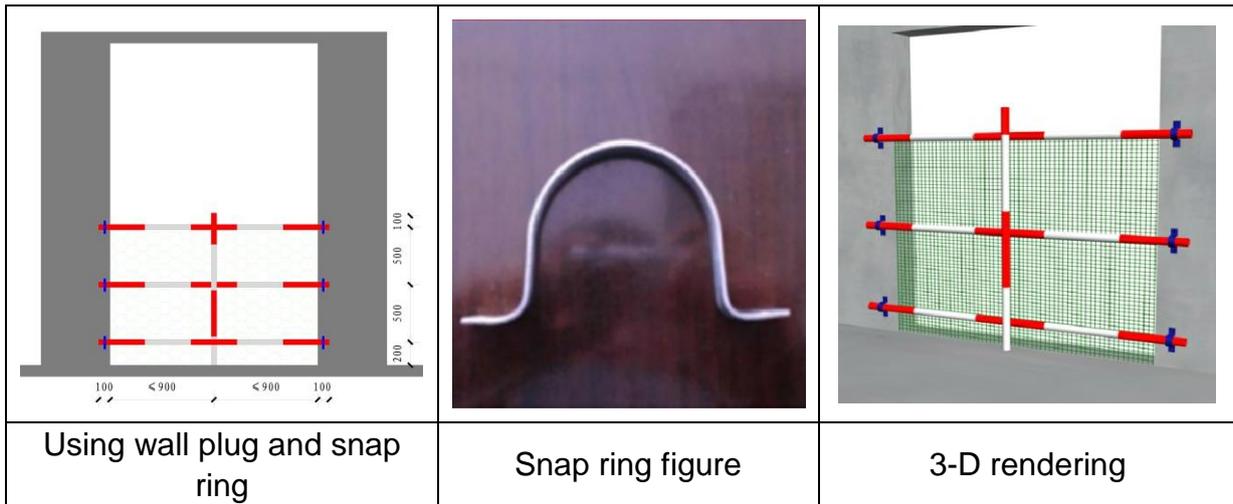
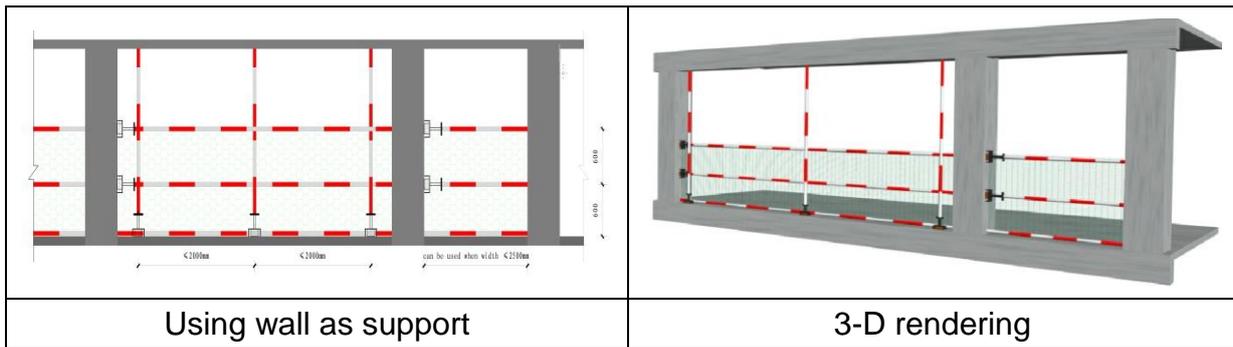
- a) The staircase landing platform install with 2 horizontal  $\Phi 48$ mm diameter steel tubes as protective railings.
- b) The protective railing pipe, stand pole pipe must be painted brush red and white stripes spacing at 400mm red and white as warning indicator.



### 15.5.1.4 Building Edge Protection

- a) When the window edge height is less than or equal to 800mm, the lateral width greater than 2000mm, it needs to set edge protection.
- b) The building edge protection must have a strong connection of vertical post.
- c) The structural column shall be hoop up with steel pipe and other corresponding part adopt the span method that buckled on the floor level with expansion bolt plug.
- d) The entire protection components shall brush painted red and white as warning indicator stripes spacing shall be 400mm.
- e) Every guardrails space between any toe-board and the lowest guard-rail above it shall not exceed 690 millimetres.
- f) Toe-boards up to a sufficient height being in no case less than 200 millimetres
- g) Top rails protection height are between 900mm-1100mm





**15.5.1.5 Safe Pedestrian Overhead Protection (Refer Chapter 4 Overhead Protection Shelter)**

- a) In the entrance of the building, or within the building surrounding the falling object radius of the pedestrian channel, need to be set up a safety passage.
- b) Safe pedestrian passage guard rails, use 48mm hollow channel combining by the erection of steel pipe, the length of the channel should be based on the height of the building, following is the table that shows the building height to determine the object fall radius distance.

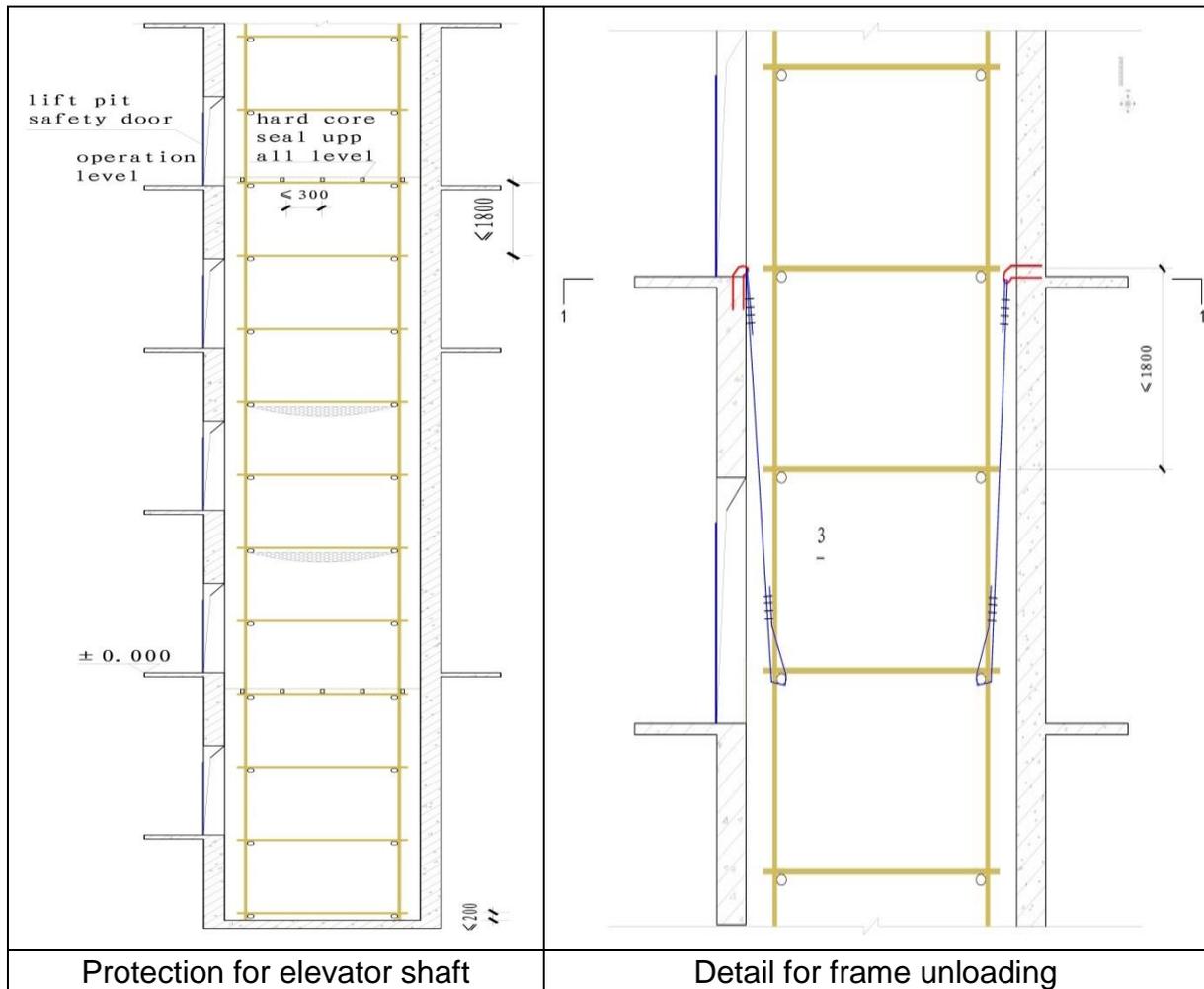
Building height (H)	Object falling radius (M)
2~5m	3m
5~15m	4m
15~30m	5m
>30m	6m

- c) Safe pedestrian passage shelter adopts double layer protection, the distance between the two layers is 800mm, and the upper and lower layers are fully covered with zinc roofing slats.

- d) At the top section of safe pedestrian passage shelter to set up safety support bearing pipe at the of height 1200mm with two horizontal pipe at roof members, bearing brush spacing is 400mm red and white warning paint, in addition to the entrance, the three face top sides filled with dense mesh safety net.
- e) Safe pedestrian passage shelter should install diagonal bracing on both sides, and full hanging mesh safety net, all horizontal pipes control the outer 100mm of the extended pipe on the horizontal post.
- f) Safety passage shelter shall install steel tube sign post (900mm x 900mm) on both side, safe pedestrian passage shelter entrance should hanging safety warning signs and safety publicity posters.
- g) Safety signs are made of PVC board or aluminium plate, outdoor use waterproof film surface.

#### **15.5.1.6 Lift Shaft, Vertical Hole Protection**

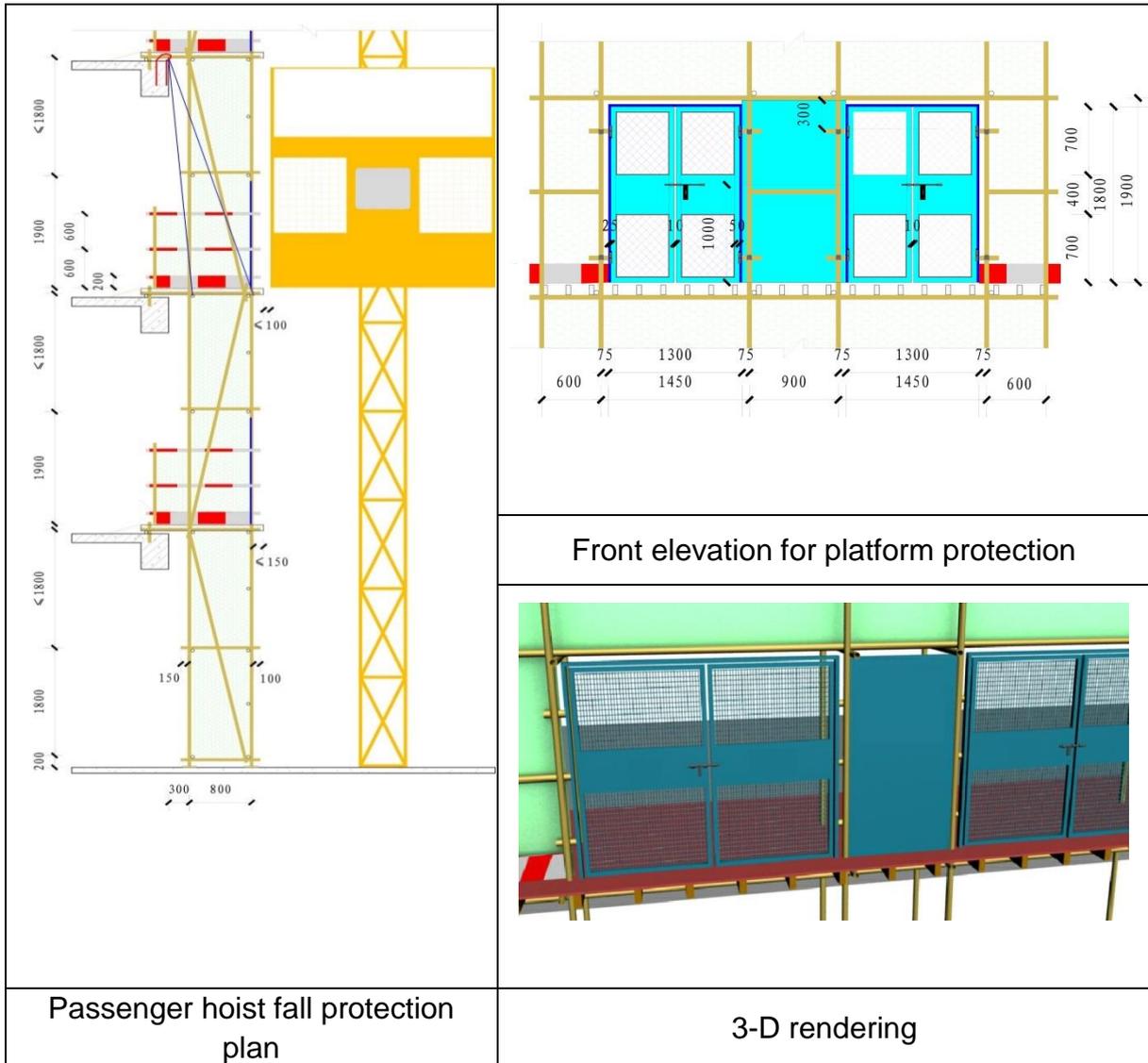
- a) Every lift shaft entrance install 1800mm height high-quality protection door.
- b) At the middle and bottom of lift shaft door install 200mm height, 1mm thick steel plate, at the bottom of steel plate brush red and white paint warning with distance of 400mm.
- c) The four corners of the protective door 50mmX30mmX2mm steel plate, use expansion bolts and lift shaft wall fixed.
- d) The lift shaft entrance doors are painted by blue paint.
- e) Elevator internal hoist way install steel operation rack, its height less than 1800mm, more than a certain height, should set the unloading device. At the next layer of hanger install safety net, below two layer of operation layer install hard core layer closed,  $\pm 0.000$  as the first closed layer; in the closed layer; each layer should install safety net.
- f) Lift shaft tool protection system is applicable to three sides of the shear wall.
- g) The lift shaft protection who no shear wall shaft can refer to "2.0 horizontal hole protection" detail, after the completion of masonry, lift installation should also do horizontal protection in the lift shaft.



On site picture for lift shaft protection.

### **15.5.1.7 Passenger Hoist Opening Protection**

- a) Passenger hoist ground level entrance need install safety passage; refer details as per "10 safe pedestrian passage".
- b) Passenger hoist support structure should be separated with external scaffold, passenger hoist's scaffold both side should install diagonal bracing, 1200mm height, base setting 200mm height, 18mm thick timber block as baseboard. Both baseboard and barrier are painted with red and white warning paint with 400mm distance, internal setup safety net, all horizontal rods control the outer 100mm of the extended rod of horizontal post.
- c) Each floor of the Passenger hoist scaffold should install member of the wall and diagonal barrier, and strictly follow the construction program requirements to take dismantle method.
- d) The distance between platform and lift guard is  $\leq 100$ mm.
- e) Install metal protective door at level dismantle platform, door frame and the frame welded with 25 x 50mm steel horal section, internal frame install 1mm thick steel board and 30 x 30 steel mesh skeleton with blue paint.
- f) The height of the protective door is 1950mm, width is 1550mm, and the switch bolt is installed on the side of the protective door.
- g) Between the doors of passenger hoist platform seal up with plywood, internal and external brush blue paint.
- h) Calling system must be set up.



## **15.5.2 Working at Height**

Many activities in the construction site require working at heights. Working at heights involves ascending/descending of ladders, carrying at height level with assistance of scaffolding and scissor lift, and elevated working platform by the use of temporary working platform. The hazards involved in working at height are mainly:-

- a) Fall from height
- b) Falling of objects such as tools/equipment/material on personnel working below.

Hence it is necessary that personnel working at heights must be familiar with the safety requirements.

### **15.5.2.1 Scope**

The following procedure is applicable to all contractor and sub-contractor employees while working within the construction site.

### **15.5.2.2 Permit to Work and Checklist (refer to Appendix)**

- a) Appendix – Working at height permit.
- b) Appendix – Integrated PTW.

### **15.5.2.3 Responsibility**

Contractor and sub-contractor supervisors are responsible to ensure that the requirements pertaining to working at heights are strictly adhered to.

### **15.5.2.4 Safety Requirement**

The following safety requirements shall be given due consideration and complied with while working at heights.

- a) Personal protective equipment (PPE)
  - i. All personnel are to wear safety harness and lanyard shall be used to anchor securely the lifeline or to any rigid point of structure while working at height of more than 2 meters.



Safety harness training

b) Access to workplace

- i. Where a permanent means of access/egress is not available, a temporary means of access by the use of ladder to be provided.
- ii. Climbing/descending over structures, equipment and beams is dangerous and prohibited, it has to achieve by use of ladder, scissor lift or scaffolding.

c) Ladders/Staircase

- i. Both hands shall be used to hold the ladders/staircase while ascending and descending.
- ii. Firm grip of hands and firm footing shall be ensured.
- iii. Persons ascending or descending shall always face towards the ladder.
- iv. Hands shall not be engaged in holding other materials or tools.
- v. Ladder shall be inspected for broken, missing, damaged or defective rungs at least once weekly.

d) Carrying of tools and accessories

- i. Tools, accessories and other items required for the carryout task at height level never be carried in hands while using a ladder. To use tool bags specially to carry tools. The tool bag has to be slung over the shoulder when ascending or descending ladders.
- ii. Tools and accessories, etc., shall be lift, lower or shift to and from elevated work places by using a rope or other safe means of lifting/lowering practices.

e) Working platform

- i. If a permanent working platform is not provided on the elevation where work is to be done, a proper scaffolding must be erected to facilitate the task.
- ii. The scaffolding shall be provided with hand rails, toe boards etc., as per the scaffolding requirements.
- iii. Temporary working platform in erected at any elevated areas it has to be provided with ladder of sufficient height attached to the platform for the purpose of access and egress safely and the platform should be installing with effective guard rail at all opening sides.

f) During the progress of work

- i. The affected area at below or at floor / ground level directly below the work area shall be cordoned off effectively by the use of warning tape and detail a person standby at the barricaded area to caution passersby of the activities at height.
- ii. Due care shall be taken to avoid falling of any tools or articles, especially through the gap opening in between the platform's. If it is not feasible to use tool bag, then tools are to be secure firmly by rope and attaching it to the body to prevent accidental droppings.
- iii. Safety harness's lanyard must be anchored to a rigid point/structure or into provided lifeline all the times while at height.
- iv. Where work to be performed at any open side or floor opening which a person is liable to fall a distance of more than 3m, effective barrier, life line or opening cover must be installed to prevent falling from height.

g) On completion of work

- i. All tools, articles and other items brought to the work area shall be removed from the places of work and the area shall be cleared off of all unwanted items. Under any circumstances no loose items are to be left at height level it has to be brought down immediately upon completion of work.

### **15.5.2.5 Working at Height by Scissor Lift (EWP)**

Before operating the scissor lift a pre-check conduct by operator has under gone training of safe operation. The following procedure shall imply for the operation scissor lift and to obtain working at height permit prior to commencement of work.

Personnel shall not operate scissor lift, only authorized person are allowed to operate scissor lift, the identification sticker to affix on helmet and he must strictly follow the safe operating procedure.

- a) Operators shall wear a safety harness attached to the scissor lift guardrail with lanyard or retractable webbing lanyard while extracting or retracting the cage platform.
- b) Work tools shall not exceed safe working load of scissor lift.
- c) Scissor lift shall only be used on a firm and level flat floor surfaces.
- d) Operators shall ensure to adhere safe operating procedures.
- e) While the cage platform at elevated level do not attempt to drive the scissor lift, the elevated cage had to retract prior to drive the scissor lift if shifting of work place takes place.
- f) Shall not operate scissor lift within 4 metres of live electrical wires without a full electrical isolation.
- g) Operators shall park the scissor lift at designed parking area for charging of battery.
- h) While scissor lift in operation the operator to ensure all buzzers are functioning.
- i) Operator shall duly complete safety checklist prior to operate scissor lift.
- j) To print prominently on the scissor lift the PMA registration number, scissor lift's SWL capacity and optionally the user's sub-contractor company name.
- k) To display a copy of PMA certificate & checklist on the scissor lift.
- l) The affected work area to barricade on floor level adequately.
- m) Only 2 persons includes the operator are permitted in the platform cage.
- n) Never modify or alter the scissor lift without written permission from the manufacturer because changes could alter the structure and stability
- o) Make sure that the emergency lowering mechanism works.
- p) Make sure that loads are within the capacity limit and are stowed properly for stability.
- q) Do not use lumber or ladders to get additional height on the platform. Do not step on guardrails or gate rungs and do not climb out of the platform for any reason.

### **15.5.2.6 Working at Height by Sky-lift**

Before operating the sky lift a pre-check to conduct with the use of checklist and the operator holds a valid driving licence issued RTD and familiar with the safe operation of sky lift. The following procedure is applicable for the operation of sky lift and to obtain working at height permit prior to commencement of work.

- a) PMA registration number and SWL to be printed on the boom and all certificates are to keep in the sky lift for inspection.
- b) Ensure the outriggers are fully extended and the outrigger footings are to be steel based plate.
- c) Only 1 person is allowed inside lifting cage.
- d) The person inside the cage is to wear safety harness and hook the lanyard to cage's guardrail all the times.
- e) Barricade the affected area at ground level adequately.
- f) Materials or tools keep inside cage are to contain it within the cage and its weight to not exceed SWL including the working person inside the cage.
- g) Never use the sky lift as a crane to lift items.

### **15.5.2.7 Working on scaffold**

Scaffolds are extensively used in the construction sites for various work processes. Once the scaffold is erected, the scaffolding inspector will inspect the scaffolding to ensure that it conforms to safety requirements and is safe for men to work. If he is satisfied, he signs the checklist and displays it on the scaffold together with safe to use tag. The following procedure adopted for safe working on scaffolding.

- a) The user of scaffolding to ensure that valid safe to use tag & checklist duly completed by scaffold inspector has displayed on the intended scaffold to be use.
- b) Persons working on scaffold are to wear safety harness and hook the lanyard on the guardrail of the scaffold throughout.
- c) Stacking of bricks on scaffold platform is to be below the level of toe board.
- d) Do not modify scaffold, only competent scaffold erector is allowed to carry out modifications.
- e) Do not remove or dismantle any part of scaffold structure, if there is a need, only competent scaffold erector is permitted to do so.
- f) To barricade adequate at ground level the affected area with warning tapes.
- g) Use only provided ladders for access and egress from scaffold platform, do not scroll down on side of scaffold by gripping on guardrails or any other structure.

### 15.5.2.8 Working at Height Using Portable Step Ladders

Portable ladders are commonly used in construction site for its expediency and reliability, hazards of falling from ladder could result in serious injury, therefore the following safe work procedure to adhere by all workers to prevent untoward incidents.

- a) The user to ensure that ladder is fitted with non-slip feet.
- b) Ensure that the ladder is placed on a firm and level footing.
- c) Where the ladder is being used to gain access to a platform or roof, the ladder is to extend beyond the platform or roof level by at least 1 metre.
- d) Do not work alone with ladders always work with a buddy to hold the ladder for stability.
- e) When working on a ladder above 2m from the ground level, the user shall wear an approved safety harness and be coupled to a fixed structure or the secured ladder via a suitable lanyard.
- f) All materials are to be raised and lowered with a rope. Small items may be placed in a safety harness bolt bag or tool frog to allow user to climb and descend the ladder using both hands.
- g) All tools to be secured effectively to prevent dropping accidentally.
- h) Do face the ladder when ascending or descending, never turn away from the ladder.
- i) Do barricade around ladders to protect them from being bumped.
- j) Do not use the top three rungs of a ladder.
- k) Do not tie or fasten ladders together to provide longer.
- l) Do not “walk” or rock a ladder side to side to move it into place.
- m) Do maintain three point contacts all the times (hands & feet).
- n) Avoid work that imposes a side loading such as side-on drilling through solid materials, by having the steps facing the work activity. Where side-on loading cannot be avoided should prevent the steps from tipping over, by tying the steps to a suitable point.
- o) Only wooden or fibreglass ladders are to be used in electrical annexes, switch rooms or near electrical cabling or circuitry.
- h) Ladder inspection :

All ladders must be inspected periodically and after any occurrence, that could affect their safe use or to carryout inspection whenever a ladder falls over and hits the ground. Always inspect the followings:-

- i. The “feet” or cleats of a ladder for damage.
- ii. The back of stepladders for stability.
- iii. Hooks and locks on straight ladders with extensions.
- iv. The rungs of the ladder for bends or breaks.
- v. The locking mechanism on a step ladder.

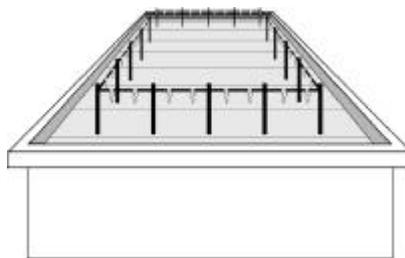
The thumb rule to determine the correct leaning angle of a straight ladder is a worker standing in front of a ladder should be able to grab a rung with both arms extended forward at shoulder level without bending forward.

#### **15.5.2.9 Working on Roof (refer Chapter 20 Roofing Work)**

If workers are working on roofs with unprotected sides and edges 3 meters or more above ground levels, they shall be protected from falling by guardrail systems, safety net systems, personal fall arrest systems or a combination of a warning line system and guard-rail system, warning line system and safety net system, warning line system and personal fall arrest system, or warning line system.

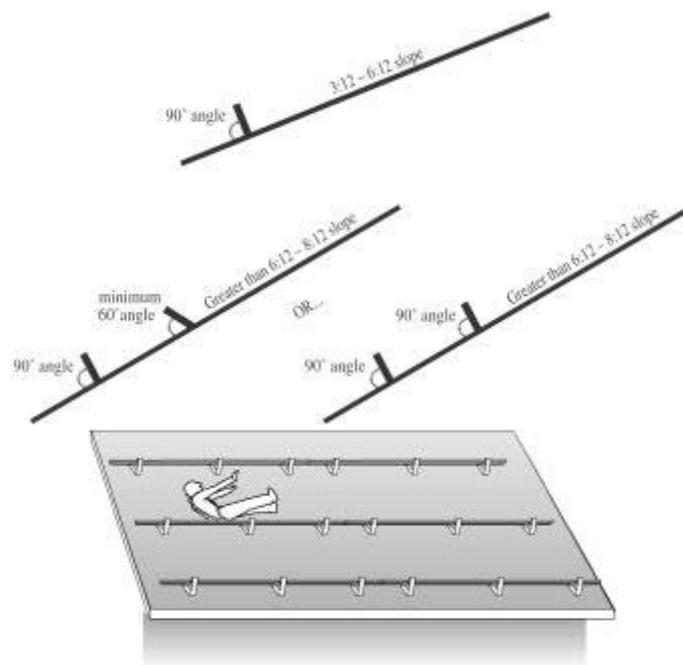
##### a) Warning line system

- i. Employees performing roofing work between a roof edge and a warning line must be protected by guardrails or safety nets erected around all open sides of the roof work area no less than 3m from the roof edge.
- ii. Points of access and material handling areas must be connected to the work area by an access path formed by two warning lines close access/offset when not in use.
- iii. Warning lines must consist of ropes, wires, or chains, and flagged every 2m with high-visibility material/warning tapes rigged and supported that its lowest point (including sag) is no less than 690mm and its highest point is no more than 1.2m.
- iv. Stanchions must be capable of resisting at least 10kg of force.
- v. Warning line must have a minimum tensile strength of 225kg.
- vi. Workers are not allowed to work between the roof edge and warning line unless performing roofing work.
- vii. Must not be use as fall protection on slopes greater than 2:12.



b) Slide guide system

- i. Installation of the system must be under direct supervision of competent person.
- ii. Cannot used on roofs with ground/eave height of 25 ft. or more.
- iii. Cannot used as fall protection on roofs with a slope less than 3:12 nor greater than 8:12.
- iv. Roofs that with slopes greater than or equal to 3:12 to and including 6:12. Minimum of one slide guard placed below the work area and not closer than 6" from the eave.
- v. Roofs that with slopes greater than 6:12 to 8:12. Multiple slide guards must be used with spaced 8' apart, vertically and lower slide guard must be placed no closer than 6" from eave.
- vi. Lowest slide guard must be 90 degrees to the roof surface.
- vii. Upper slide guards cannot be less than 60 degrees to the roof surface.



#### 15.5.2.10 Working at Height for Steel Structure or Precast beam Installation

To apply hoisting permit refer Appendix.

Accidents during steel erection or installation of precast concrete beams may cause serious injuries at construction sites, the formulation of safe work procedure will provide greater protection and eliminate hazards associated with steel erection and

will thus reduce the incidence of injuries in the construction sites.

Major hazard is fall from height may occur in the steel erection or installation of precast concrete beams activity which involves walking, working and climbing surfaces in steel beams or precast beams while installation operations when fall protection is not used, hence following safe work procedure to adhere.

- a) Fall protection system consist of safety harness, along with an anchorage, connectors together with a lanyard including lifeline be install to prevent the user from falling any distance beyond 3m of height.
- b) Cranes and sky lift used to carry out the activities shall be visually inspected prior to commencement of operation in accordance of crane inspection checklist/sky lift inspection checklist and shall observes for deficiencies during the operation.
- c) Routes for suspended loads shall be pre-planned and arranged to ensure that no person is required to work directly below a suspended load except for person engaged in the initial connection, hooking or unhooking of the load.
- d) Structural stability to maintain at all times during the erection process.
- e) Purlins and girts are not to be used as an anchorage point for a fall arrest system.
- f) Prior to installation ensure that the anchor rod is undamaged and if found any damaged anchor rod it shall be report immediately to project management for rectification and do not attempt to self-repair, replace or field-modify.
- g) Sky lift to be fully utilize for the purpose of workers access to the height level during installation process.
- h) The installed fall protection lifelines shall be test for breaking strength of not less than 200kg.
- i) Installing activity to cease immediately if weather condition change so as raining, thunderstorm and strong windy.
- j) The installation supervisor must conduct site safety briefing to his workers on the procedures pertinent to sequences of installation and safety practices before commencement of work.
- k) For disconnecting hooks from beams to use ladder if below 3m of height and if height exceeding 3m it has to be disconnect with the utilization of sky lift.
- l) Must appoint or designate a person as safety monitor.
- m) Do not release the hoisting hook until the member securely bolt or fasten into position each structural steel member before releasing the load line.
- n) When setting steel trusses, temporarily cross brace them until permanent bracing is installed.
- o) Use tagline or guide rope on all hoist to prevent swing of the load.

a) Safety monitoring system:

A safety monitoring system means a fall protection system in which a designated person is responsible for recognizing and warning employees of fall hazards. The duties of the safety monitor are to:

- i. Warn by voice or whistle when approaching the open edge in an unsafe manner.
- ii. Warn by voice or whistle if there is a dangerous situation developing which could not be seen by another person involved with product placement, such as a member getting out of control.
- iii. Make the designated erectors aware they are in a dangerous area.
- iv. Be familiar in recognizing fall hazards.
- v. Warn other workers when they appear to be unaware of a fall hazard or are acting in an unsafe manner.
- vi. Be at the working area closely or on same surface so as the monitored erectors within visual sight distance of the monitoring person.
- vii. Be close enough to communicate orally with the employees.
- viii. Not allow other responsibilities to encumber monitoring. If the safety monitor becomes too encumbered with other responsibilities, the monitor shall (1) stop the erection process; and (2) turn over other responsibilities to a designated erector; or (3) turn over the safety monitoring function to another designated person.

The safety monitoring system shall not be used when the wind is strong enough to cause loads with large surface areas to swing out of radius, or result in loss of control of the load, or when weather conditions cause the walking/working surfaces to become wet or slippery.

### **15.5.2.11 Working at Height Using Crane Skips**

The following procedure is adapted to work safely using crane skips.

- a) Crane skips shall comply with statutory requirements.
- b) Users of crane skips shall wear an approved safety harness attached to the crane hook via a lanyard or retracting web lanyard.
- c) The SWL of the crane skip shall not be exceeded.
- d) The crane skip shall only be used on crane hooks fitted with safety catches - unless a Trained Rigger can satisfactorily mouse the hook.
- e) A visual inspection shall be done prior to use, checking shackles, hammerlocks, chain, slings and cracks, kinks and defects.
- f) Report all faults immediately to Safety Officer or Trained Rigger.
- g) Crane skips shall only be used on cranes operated by a competent crane operator approved by DOSH Malaysia.
- h) Crane skips shall not be used on mobile or fixed gantry type cranes with a capacity of less than 2000kg.
- i) Crane skips shall not be used within 4m of exposed live electrical wires without a full electrical isolation.
- j) Crane skip shall be returned to proper storage area upon completion of work.

# APPENDIX 1 WORKING AT HEIGHT PERMITS



**GIANT LEAP CONSTRUCTION SDN. BHD.**

## Working at Height Permit

This permit can be obtained from GIANT LEAP Safety Department		Permit no.:	
This permit is valid for 7 days from the day of approval. Application must be submitted one day in advance.			
<b>Part 1: Application – To Be Completed By Sub-Contractor</b>			
Work Performed by :	(Name of Subcontractor)		Location:
Name of Supervisor in Charge:			
Date & Time:	From:	To:	No. of workers:
Safety Requirements to be complied with Prior Application of working at height permit:			
<ul style="list-style-type: none"> <li>€ Cordon off or barricade work area.</li> <li>€ Provide warning signs to warn other below the working area</li> <li>€ Safety harness to be don all the times and anchor to strong structure or provided lifeline.</li> <li>€ Working platform shall comply to Reg. 85, 87,88,89 &amp; 90 FMA (BOWEC) Regulation.</li> </ul>		<ul style="list-style-type: none"> <li>€ Proper safety nets to install under the works when working platform and safety harness are not practical .</li> <li>€ Guardrail to install at platform to prevent person from fall from height.</li> <li>€ Secure handheld tools with an attach string to prevent accidental drop upon loose grip</li> <li>€ All tools, equipment and loose material shall be brought to ground level when work is interrupted or completed.</li> <li>€ To provide effective barriers if working at open side or floor opening at height more than 3m.</li> </ul>	
Sketch		Requested by:	
		Name:	
		Signature:	
		Date/Time:	
		Description of work :	
Name of designated safety monitor : (For installation of steel structure & precast beams only).			
<b>PART 2: Acknowledgement By –GIANT LEAP Supervisor</b>		<b>PART 4: Approval By –GIANT LEAP Area Site Manager</b>	
Acknowledge work to be done Comments: _____		The above mentioned work is <b>APPROVED / NOT APPROVED</b>	
Name / Signature	Date / Time	Name / Signature	Date / Time
<b>PART 3: Checking By – GIANT LEAP Safety Dept.</b>			
Ensure all the safety provisions/requirements in PART 1 are fulfilled.			
Others:			
Name	Signature:	Date / Time:	
<b>PART 5: Notification of Completion of Work by Sub-Contractor</b>			
The above work was completed on:			Date / Time:
Name	Signature:	Date / Time:	
Note:	To be displayed prominently at the work area.		
*Delete where applicable.			
ALL THE APPROPRIATE SIGNATURES MUST BE OBTAINED BEFORE WORK STARTS.			
<b>PART 6: Daily endorsement by sub-contractor safety or representative to verify the compliance of safety requirement at Part 1.</b>			
Date			
Name			
Signature			

## APPENDIX 2 INTEGRATED PERMIT TO WORK

GIANT LEAP CONSTRUCTION SDN. BHD.

### INTEGRATED PERMIT TO WORK PLOT 4 FOREST CITY BLOCK 5

Date :					Sub-contractor :	YONG FU CONSTRUCTION SDN. BHD.							
PART 1 : Application - to be completed by sub-contractor													
Requested by :					Signature			Time :					
<b>HOISTING</b>													
PMA No.	<b>SAFETY REQUIREMENTS</b> <input type="checkbox"/> Lifting gears & appliances in use are free of defects <input type="checkbox"/> Load is properly & securely rigged <input type="checkbox"/> Pads are applied to sharp edges of load to be lifted				<input type="checkbox"/> Lifting hooks provided with safety latches <input type="checkbox"/> Load to be lifted is within the stipulated safe working load of crane <input type="checkbox"/> Tag line / guide line to be used to guide the load		Remarks	Acknowledge	Endorsement	Approval			
Operator Name							Signalman : 1. .... 2. .... Rigger : 1. .... 2. ....	Lifting Supervisor	Safety Department	Asst. Project Manager			
Additional measures :								YI SI PING Date : Time :	FARHAN Date : Time :	PENG PING Date : Time :			
Daily endorsement by Sub-contractor	Date												
	Time												
	Signature												
<b>WORKING AT HEIGHT</b>													
<b>SAFETY REQUIREMENTS</b> <input type="checkbox"/> Wear safety harness and hook. <input type="checkbox"/> Install guardrail on working platform. <input type="checkbox"/> Provide ladder for access/egress.							<input type="checkbox"/> Use proper working platform. <input type="checkbox"/> Provide handrail for access/egress ladder. <input type="checkbox"/> No loose materials kept on platform.		Acknowledge	Endorsement	Approval		
									Site Supervisor	Safety Department	Asst. Project Manager		
Additional measures :								LIANG CAI FU Date : Time :	FARHAN Date : Time :	PENG PING Date : Time :			
Daily endorsement by Sub-contractor	Date												
	Time												
	Signature												
<b>HOT WORK</b>													
<b>SAFETY REQUIREMENTS</b> Type of hot work : <input type="checkbox"/> Welding <input type="checkbox"/> Oxy-Ace-cutting <input type="checkbox"/> Rotating disc cutter <input type="checkbox"/> Grinding <input type="checkbox"/> Bracing							<input type="checkbox"/> Provide fire extinguisher <input type="checkbox"/> Install flash-back arrestor <input type="checkbox"/> Oxy-Ace cylinder 3m away from hot work area. <input type="checkbox"/> Use welding hood for welding <input type="checkbox"/> Wear goggle for grinding.		<input type="checkbox"/> Provide fire blanket <input type="checkbox"/> Area free combustible material. <input type="checkbox"/> Gas hose not damage. <input type="checkbox"/> Wear dark safety glass for cutting <input type="checkbox"/> Cables are in good condition.		Acknowledge	Endorsement	Approval
									Site Supervisor	Safety Department	Asst. Project Manager		
Additional measures :								LIANG CAI FU Date : Time :	FARHAN Date : Time :	PENG PING Date : Time :			
Daily endorsement by Sub-contractor	Date												
	Time												
	Signature												
Notification of work completion by Sub-contractor: <b>YONG FU CONSTRUCTION SDN. BHD.</b>									Date	Time			
The above mentioned works has been completed :							HOISTING :						
							WORKING AT HEIGHT :						
							HOT WORK :						
Name :					Signature :								

## APPENDIX 3 FALL PROTECTION CHECKLIST



GIANT LEAP CONSTRUCTION SDN. BHD.

### Fall protection and falling object inspection checklist 防落人落物检查表

S/No.	Items 项目	Yes 是	No 否	Remarks 备注
1.	Is there any lifeline install at steel structure installation work area. 钢结构安装区域是否有救生绳			
2.	Building floor edge: Is there any safety railing install with netting at the edges? 建筑楼层边缘: 边缘是否安装了围栏和安全网			
3.	Floor hole opening: Is there any safety railing install surrounding floor hole? 楼层开洞: 开洞周围是否安装围栏			
4.	Staircase: Is there any safety railing install on open sides of staircase? 楼梯: 楼梯开放面是否安装扶手			
5.	Access and egress point: Is there any overhead shelter protection install at the designated points? 出入口: 是否在指定出入口处安装安全顶篷			
6.	Floor holes: Are the floor holes has been covered adequately? 楼层穿孔: 是否将楼层穿孔盖住			
7.	Safe passage: Does specific safe passage designated? 安全通道: 是否已指定专用安全通道			
8.	Lift pit: Is there any safety railing install surrounding the pit? 电梯井: 是否在周围安全围栏			
9.	Drains: At drain crossing point install with handrail on both sides? 排水管道: 是否在排水管道交汇处两侧安装栏杆			
10.	Formwork edge: Railing with netting has been installed? 模板边缘: 是否安装戴安全网围栏			

Floor hole includes: duct hole, lift well, stair well.  
楼层开洞包括: 预留管道口、电梯井、楼梯井

If the answer 'NO' any of the above items, immediate remedial action to be taken to mitigate the risk by re-installing the lifeline/barricade or stop work if any work activity at the affected area if re-installation is not feasible to carryout immediately.

如以上任一项答案为“否”，应立即采取措施进行整改，可再次安装救生绳/围栏，以降低风险。如整改措施不能立即进行，应停止在影响区域内作业。

To notify the safety officer, project manager and sub-contractor's management if any work stoppage due to the unsafe condition arising from unavailability of fall protection or unprotected falling object zones.  
因无防落人落物保护等危险条件而停工，需上报至安全官、项目经理以及分包管理人员。

Demarcate the affected area to precaution others the presence of unsafe condition.  
对受影响区域划定边界，提醒他人此处有危险。

Inspected By: 检查人	
Date: 日期	
Signature: 签名	

# **CHAPTER 16**

# **MECHANICAL AND ELECTRICAL**

## Chapter 16 Mechanical and Electrical

### 16.1 Introduction

Mechanical engineering is a diverse subject that derives its breadth from the need to design and manufacture everything from small individual parts and devices (e.g., micro scale sensors and inkjet printer nozzles) to large systems (e.g., spacecraft and machine tools). The role of a mechanical engineer is to take a product from an idea to the marketplace. In order to accomplish this, a broad range of skills are needed. The mechanical engineer needs to acquire particular skills and knowledge. He needs to understand the forces and the thermal environment that a product, its parts, or its subsystems will encounter; to design them for functionality.

### 16.2 Objective

This Guideline gives guidance on the good design, installation, inspection, testing, operation and maintenance.

### 16.3 Definition

A form of energy that is efficient and simple

- a) **Current** – Electrical movement (measure in amps)
- b) **Resistance** – Restriction to electrical flow.
- c) **Grounding** – a conductive connection to earth which acts as a protective measure
- d) **Conductor** - Substances, like metals, with little resistance to electricity that allow the electricity to flow.
- e) **Insulators** – Substance with high resistance to electricity like glass, porcelain, plastic, and dry wood that prevent electricity from getting to unwanted areas.
- f) **Voltage** – Measure of electrical force.
- g) **Plumbing** – any system that conveys fluids for wide range of application.
- h) **PVC** – known as polyvinyl chloride, a rigid plastic pipe usually use for plumbing system to replace steel pipes.
- i) **AHU** – known as air handling unit which is a device used to regulate and circulate air as part of heating, ventilating and air conditioning system (HVAC)
- j) **Authorized Lockout/Tag out Employee** - A person who has completed the required hazardous energy control (LOTO) training and is authorized to lockout or tag out a specific machine or equipment to perform service or maintenance.
- k) **De-energized electrical work** - Electrical work that is performed on equipment that has been previously energized and is now free from any electrical connection.
- l) **Disconnecting/Isolating switch** - A device designed to close and/or open an electric circuit.

- m) Energized Electrical Work** - Repair, maintenance, troubleshooting, or testing on electrical circuits, components, or systems while energized/live.
- n) Energy Source** - Any source of electrical, mechanical, hydraulic, pneumatic, chemical, thermal, or other energy.
- o) Exposed Electrical Parts** - Energized parts that can be inadvertently touched or approached nearer than a safe distance by a person. Parts not suitably guarded, isolated, or insulated. (i.e. terminal contacts/lugs, bare wiring, etc.).
- p) Ground Fault Circuit Interrupt (GFCI)** - A device whose function is to interrupt the electric circuit to the load when a fault current to ground exceeds a predetermined value that is less than that's required to operate the over-current protective device of the supply circuit.
- q) Ground** - A conducting connection, whether intentional or accidental, between an electrical circuit or equipment and the earth. Or, to some conducting body that serves in place of the earth.
- r) Hazardous location** - An area in which an airborne flammable dust, vapour or gas may be present and would represent a hazard if a source of ignition.
- s) High voltage** - Circuits with a nominal voltage more than 600 volts.
- t) Interlock** - An electrical, mechanical, or key-locked device intended to prevent an undesired sequence of operations.
- u) Isolating power system** – A system comprising an isolating transformer or its equivalent, a line isolation monitor, and its ungrounded circuit conductors.
- v) Life safety equipment** - Equipment that provides critical protection for safety, in the event of an emergency or other serious hazard.
- w) Lockout** - The placement of a lock on an energy-isolating device according to procedure, ensuring that the energy isolating device and the equipment being controlled cannot be operated until the lockout device is removed.
- x) Lockout/ Tag out** - A standard, that covers the servicing and maintenance of machines and equipment in which the unexpected re-energization of the equipment or release of stored energy could cause injury to employees.
- y) Tagout** - The placement of a tag out device on an energy-isolating device according to procedure to indicate that the equipment may not be operated until the tag out device is removed.
- z) Low voltage** - Circuits with a nominal voltage less than or equal to 600 volts.
- aa) Switching devices** - Devices designed to close and/or open one or more electric circuits. Included in this category are circuit breakers, cut-outs, disconnecting (or isolating) switches, disconnecting means, interrupter switches, and oil (filled) cut-outs.
- bb) Outlet** – A point of the wiring system at which current is taken to supply utilization equipment.
- cc) Over-current** – Any current in excess of the rated current of equipment of the capacity of a conductor. It may result from overload, short circuit, or ground fault.
- dd) Qualified person:** One who has received training in and has demonstrated skills and knowledge in the construction and operation of electric equipment and installations and the hazards involved.

- ee) Remote-Control Circuit** - Any electric circuit that controls any other circuit through a relay or an equivalent device.
- ff) Service** - The conductors and equipment for delivering energy from the electricity supply system to the wiring system of the premises served.
- gg) Service Equipment** - The necessary equipment, usually consisting of a circuit breaker or switch and fuses, and their accessories, located near the entrance of supply conductors to the building and intended to constitute the main control and means of cut off of the supply.

## **16.4 Legal Requirements**

- a) Act mean the Electricity Supply Act 1990 [Act 447], Electricity Supply (Amendment)
- b) Act 2015 [Act A1501] and its subsequent amendment, if any.
- c) BOWEC Regulation 16: Electrical Hazard
- d) BOWEC Regulation 25 : Ventilation
- e) Use and Standards of Exposure of Chemicals Hazardous to Health Regulation 2000

## **16.5 Procedure**

### **16.5.1 Mechanical Safety**

In the aspects of building design and construction, mechanical part of building construction includes:

- a) Plumbing
- b) Mechanical Ventilation and Air Conditioning System (MVAC system)
- c) Sprinklers

#### **16.5.1.1 Plumbing system and Sprinklers**

Plumbing system in building consists of underground tank which supplied water via municipal or water department supply lines, from there with the help of pumps and piping distribution system water is supplied to overhead tank and thereby due to gravity, water reaches to home outlets.

##### **a) Safety and health issue**

Safety and health issue in plumbing work are variety of setting which include:

- i. Exposure of hazardous substance such as lead, sulphur dioxide, mould, adhesive solvent and other toxic.
- ii. Proximity to flammable or combustible material
- iii. Working in awkward position or performing awkward manual task which increased risk of musculoskeletal injuries.
- iv. Lifting heavy or awkward object.

- v. Slips, trips and fall especially when working at wet environment.
- vi. Burn from grinding, cutting, and hot work done.

#### **b) Safety Procedures**

- i. Comply with main contractor safety rules.
- ii. Apply working at height permit if doing work at high places. (**Refer to Chapter 15 : Fall protection and Working at Height**)
- iii. Apply for hot work permit if doing welding activity. (**refer to Chapter 14 Concrete Work**)
- iv. Get training on the potential hazards at the job site.
- v. Refer and review Safety Data Sheets (SDS) about the chemical used.

#### **c) Use of chemical substance**

The most common substance use in plumbing system is PVC cement. PVC cement used to soften the pipes and weld pieces of plumbing together. Although the glue dries quickly and forms a strong bond, it can be hazardous to health if comes to contact with skin or inhaled.

- i. Health issue

PVC cement produces great deal of vapour which can cause eye irritation, headache, dizziness and respiratory problem. When heated PVC product can produce HCL fumes which toxic to human (**Refer to Chapter 26 Health Issue**)

- ii. Fire Safety

PVC vapour is highly flammable, so there is high risk of explosion or flash fire. PVC gas is also heavier than air, causing it to settle and remain for days if the room is not properly ventilated. Avoid doing any hot work nearby as it may cause an explosion and fire. Using PVC product in a well-ventilated room is therefore essential.

**d) Ergonomic Factor (Refer to Chapter 26 Health Issue)**

Working on installing plumbing system can cause musculoskeletal disorder as awkward positioning during working. Most of the worker require to look up for a long times that can cause neck stiffness. This can be reduced by:

i. Working with buddy

Using two man work system can reduce time of exposure to awkward position. This can allow one worker to rest while other doing the work before he started the work and his partner rest.

ii. Material handling

In handling heavy material to install the piping support from machinery can be done to reduce the risk. By using pulley system or genie lift heavy lifting can be done without stressing on the worker. Furthermore it help to reduce risk of falling when they working on the ladder.

	
Genie Lift	Buddy system to prevent collapsing of the stairs.

**e) Slip, Trip and Fall**

Workers usually using ladder to install the plumbing system. This may cause them to slip and fall. **(Refer to Chapter 15: Fall protection and Working at Height)**

**f) Chemical and Material Storage**

- i. Read chemical labels and SDSs for specific storage instruction
- ii. Store chemicals in a well-ventilated area.
- iii. Maintain an inventory of all chemical in the storage.
- iv. Stack and block poles to prevent spreading or tilting unless they are in rack

**g) PPE (Refer to Chapter 21 PPE)**

**16.5.1.2 Mechanical Ventilation and Air Conditioning System (MVAC)**

HVAC is the technology of indoor and vehicular comfort. Its goal is to provide thermal comfort and acceptable indoor air quality. MVAC system design is a sub discipline of mechanical engineering, based] on the principles of thermodynamics, fluid mechanics and heat transfer.

The objective of an MVAC system is to ensure that indoor environment is both safe and comfortable for humans. Safety here is mainly concerns the *Indoor Air Quality* meaning that the indoor air should have enough oxygen and be free of noxious gases.

**a) Designing MVAC System**

- i. All AHU rooms must have a floor drain, as condensation from the air will collect in the unit
- ii. One should provide fresh air to every AHU
- iii. Split Units do not provide any fresh air, they must be use only when one is certain that the doors to the space will be open frequently.
- iv. All AHU rooms and fan rooms will be at negative pressure, so the door leading to them must open outwards and be airtight.
- v. Any rooms with foul air should be provided with extraction, so that they remain at negative pressure. This will prevent the foul air from drifting out to other space eg kitchen and toilet.
- vi. In an office it is a good idea to provide standalone AC units for conference rooms and executive cabin.
- vii. MVAC system must have safe access and egress for maintenance purposes.

b) Installing MVAC system.

i. Ducting fabrication

Ducting fabrication usually done in the fabrication yard before send to the site for installation. This process requires cutting, welding and joining metal part.

ii. Bracketing

This process requires cutting, grinding and drilling before hoisting the material for installation. As this part of activity PPE (**Refer to Chapter 21 PPE**) must be worn at all time to ensure safety of the worker. The power tool must be inspected before using (**Refer to Chapter 24 Machinery and Equipment**) and working on the ladder are part of the process. (**Refer to Chapter 15 Fall Protection and Working at Height**).

iii. Insulation of ducting part

Insulation of the ducting part requires using chemical and glue to ensure the insulation not tear up when condensed. When the use of chemical, SDS must be review to prevent worker from harms. Using appropriate PPE and storage of the chemical must be done.

iv. Hoisting ducting part to the ceiling

These parts require two man jobs. As hoisting of the heavy part of ducting support from machine such as genie lift are suggested to prevent injury. The awkward positioning of the body also needs to be considered to prevent any musculoskeletal disorder.

c) Testing

Test must be done before running the system to ensure occupant welfare. The testing includes:

- i. Sound and vibration test
- ii. Gas monitoring
- iii. Fume, dust, and water filtration system.

d) Monitoring and maintenance

Monitoring and maintenance must be done to ensure safe ventilation system. As the MVAC system have compressor, air filters and lead-lag configuration this system need to be monitor to prevent failure, outage and sometimes even equipment damage. Part of the monitoring includes

- i. Temperature sensors
- ii. Airflow sensors
- iii. Foul odour or mold.

## **16.5.2 Electrical safety**

### **16.5.2.1 General Safety**

Electric is a form of energy that is produced from the flow of electrons. It is a general term that includes energy related to electricity charges, whether static or dynamic.

- a) Volt
- b) The force of electric energy
- c) Ampere
- d) Actual flow of electricity
- e) Ohm

Characteristic for the circuit or route of which electricity flows and offers resistance to the current

**Hazards include:**

- a) Electric shock
- b) Lighting
- c) Fire
- d) Electrostatic

### **16.5.2.2 Electrical Installation**

**Includes:**

- a) Circuit
- b) Conductor
- c) Main switch, local and distributing board
- d) Circuit breakers
- e) Fuse
- f) Socket and plug

### **16.5.2.3 General Requirement**

#### a) Grounding

Grounding a tool or electrical system means intentionally creating a low-resistance path that connects to the earth. This prevents the build up of voltages that could cause an electrical accident. A service or system ground is designed primarily to protect machines, tools, and insulation against damage. An equipment ground helps protect the equipment operator. It furnishes a second path for the current to pass through from the tool or machine to the ground. This additional ground safeguards the operator if a malfunction causes the tool's metal frame to become energized.

#### b) Guarding

Guarding involves locating or enclosing electric equipment to make sure people don't accidentally come into contact with its live parts. Effective guarding requires equipment with exposed parts operating at 50 volts or more to be placed where it is accessible only to authorized people qualified to work in it.

- c) Equipment of 50 volts or more shall be guarded against accidental contact by approved cabinets or other enclosure or other means such as;
- i. By location in a room
  - ii. By suitable permanent, substantial partition or screen
  - iii. By placement
  - iv. By elevation of 8 feet or greater
  - v. Entrances with exposed parts, shall be marked: "Danger", "Warning" or "Caution"

### **16.5.2.4 Electrical Hazards Electrostatic**

Results that are produced by electricity charges trapped in isolators. The charges may be distributed inside or outside objects that have been isolated or it may concentrate on conductors that have been earthed

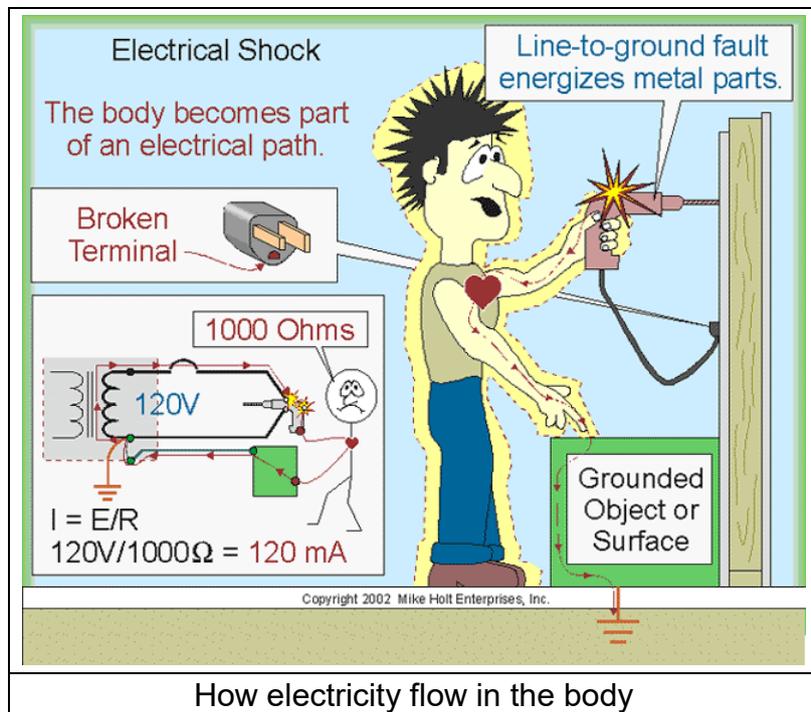
High voltage, low current

Effect of electric shock and ignition sources in a highly flammable environment, if charges are high.

d) How electricity flow in the body

High pain

Moderate pain



Minimum Threshold for Feel	10 -12 Volt
Minimum Threshold for Pain	15 Volt
Minimum Threshold for Excessive	20 volt
Minimum Threshold for Voltage Grip	20 - 25 Volt
Vibration	50/60 - 2000 Volt

#### **16.5.2.4 Electrical Safety**

- a) Protection from direct contact
  - i. Provides isolation to parts of equipment's that has potential to release charges
- b) Protection from indirect contact
  - i. Provides effective earthing to isolate metals that can charge electricity in case of failure of the main isolator.
- c) Mechanism of protection against electricity

Considerations:

- i. Circuit protector
  - ii. Isolating switch
  - iii. Equipment maintenance and repair
  - iv. Earthing
  - v. Protection
- d) All electric equipment's used must have a fuse and circuit breaker that is suitable to prevent it from overloading.
- e) Isolating switch:
- i. Labelled
  - ii. Easy reachable from the floor
  - iii. Is attached to each individual machinery
  - iv. Possess safety lock when in 'off' position
  - v. Prepare rules and conduct inspection monitoring
  - vi. Prepare a maintenance programme /schedule
  - vii. Prepare access around the equipment to allow easy maintenance and repair.
  - viii. Works done by a competent technician.
  - ix. Circuit is connected direct, not through a switch
  - x. Provide for earth leakage protection such as Residual Current Devices
  - xi. Have an emergency stop switch, interlock switch
  - xii. Isolate the conductor
  - xiii. Display appropriate warning signage's

#### **16.5.2.4 Safe Work Practice**

Workers need to follow safe practice on how to work safely in jobs involving electrical work. The following list can be used for safe work practice:

- a) Use checklist to make sure that everything is good and safe before start work.
- b) Inspect tools, equipment and electrical fitting for damage or wear prior to each use. Repair or replace damaged equipment immediately. (**Refer to Chapter 24 Machinery and Equipment**)
- c) Use cords or equipment that related for the level of amperage or wattage,
- d) Do not use outlets or cords that have exposed wiring.
- e) Do not use power tools with guard removed.
- f) Hang the wire to ensure not to submerge into water that can cause electrical shock or trip.
- g) Check electrical cable and plug daily and remove the worn of or damaged cable.
- h) Use industrial socket to ensure safety.
- i) Always use the correct size fuse or breaker.
- j) Be aware that unusually warm or hot outlets may be sign that unsafe wiring condition exists.
- k) Use proper PPE for electrical job.
- l) Always use ladder made of wood or other non-conductive materials when working with or near electricity or power lines.
- m) Know the location of the breakers and boxes in case of emergency
- n) Label all circuit breakers and fuse boxes clearly.
- o) Do not operate the electrical equipment when standing in the water.
- p) Have qualified electrician inspect electrical equipment that has gotten wet before energizing it.
- q) Do not repair electrical equipment unless qualified and authorized.
- r) Post warning sign to make sure worker aware of the electrical hazard.

#### **16.5.2.5 Installation, Monitoring and Maintenances.**

- a) Installation
  - i. Energization of electrical system must be done by certified person following requirement from **Act mean the Electricity Supply Act 1990 [Act 447], Electricity Supply (Amendment)**.
  - ii. The dimensions of the cable trays must be sufficient, with 50% spare space and calculated so as to hold only one layer cable
  - iii. Temporary supplies for each floor have their own distribution boxes to avoid overload and fire.
  - iv. All cable must be elevated or hanging to avoid contact with wet floor and tripping hazard

- v. Usage of industrial socket is must to ensure safety.
- vi. All distribution box (DB) boxes must be lock at all times to avoid worker to adjust it without supervision.

b) Monitoring

- i. Supervisor must ensure that worker do not use multiple socket to avoid overload.
- ii. Normal domestic socket are prohibited at the construction site.
- iii. All electric cable which lying on the floor must be elevated.
- iv. Damaged power tool must be reported, remove immediately and tag as “unsafe” until rectification done.
- v. Any damage cable must be rectify immediately to prevent electrical shock.

c) Maintenances

- i. Electrical equipment and apparatus must be maintained in good working order. Any equipment with an identified as fault must be removes from service, until the fault is rectified.
- ii. Any such repair or alteration must be recorded in the instrument log book.
- iii. Repair to any main power circuit (240V or 3-phase) may only done by licences electrician (PW4) or authorized technician. These repairs must be tested and tagged as electrically safe, by competent person before return to use.
- iv. Repair to circulatory or components that are separate to the mains power circuit (e.g.: digital or low voltage) may be undertaken by worker with authorization from supervisor.
- v. All low voltage repair must be recorded.

	
Floor wiring PVC sleeve fixed laying	Temporary DB Box for each floor



Lighting fixtures at night



Distribution cabinet electrical configuration



Temporary wiring at site



Industrial socket used



Electrical cable hanging to avoid soaking in the water and tripping hazard

# **CHAPTER 17**

# **PLASTERING AND BRICK WORK**

## Chapter 17 Plastering and Brick Work

### 17.1 Introduction

Plasterwork refers to construction or ornamentation done with plaster, such as a layer of plaster on an interior or exterior wall structure, or plaster decorative moldings on ceilings or walls. The process of creating plasterwork, called plastering or rendering, has been used in building construction for centuries.

### 17.2 Objective

The objectives of this chapter are:

- a) Understand safe work for plastering and brick work
- b) Determine the health hazard when working with cement.
- c) Ensure meet the safety requirement and environmental requirement.

### 17.3 Definition

- a) **Plaster** - defined as Lean Mortar used mostly for covering masonry surfaces. They are lean mixes of Binding Materials (Lime or Cement) with fillers material such as, Sand or Crushed stones. And the process of covering surfaces with Plaster is called Plastering.

### 17.4 Legal Requirements

- a) FMA139 Safety, Health and Welfare 1970 Regulation 26.
- b) FMA129 BOWEC 1986 Regulation 11 and 15.

### 17.5 Procedure

#### 17.5.1 General Safety

To ensure that all the necessary preparation needed will be handled in the early stage and anticipate problems that may later arise.

**Hazards include:**

- a) Trip and Falling from height
- b) Mixing Cement Dust
- c) Drop of Materials.
- d) Repetitive movement

Plaster worker shall wear correct type of safety shoes, body harness, and glove before start work. (**Refer to Chapter 21 PPE and Chapter 15 Fall Protection and Working at Height**)

### **17.5.2 Brick Works**

- a) Prohibited to other workers to enter the area of the brick work except brick layer by installing the signage's.
- b) Brick layer shall wear a safety helmet and gloves to protect hands from bruise or cement Corrosiveness.
- c) Brick must be stacked in proper manner whether on floor or on working platforms.
- d) Provide heavy duty working platform at least 1100mm wide with fully covered flooring, but do not use timber below 50mm thick by 200mm width.
- e) All working platforms shall be provided with guardrails or edge protection and access.
- f) Housekeeping shall be done regularly after end of the day
  - i. Materials/ Personal Protective Equipment:
  - ii. Safety Helmet
  - iii. Safety Shoes / Safety Rubber Shoes.
  - iv. Semi Leather Gloves / Cotton gloves.
  - v. Safety Harness

### **17.5.3 Plastering Works**

- a) Housekeeping shall be made regularly every day after end of the work.
- b) Provide proper access and working platform for material and person of work.
- c) Wear proper hand gloves to protect hand from corrosion of cement mortar.
- d) Dust mask shall be worn by a person work with dry cement.
- e) Wear safety helmet except the worker is closed to the soffit level due to obstructions.
- f) Wear safety glasses while doing overhead plastering works.
- g) Edge protection shall be providing to the working platform or work is done close to elevated place.
- h) Provide life lines if erection of edge protection impossible. (Refer Chapter 15 Fall Protection and Working at Height)**
  - i) Wear safety harness if working more that 2m high.
  - j) Ground level shall barricade with signage

#### **17.5.4 To Comply with Safety Rules and Regulation.**

One of the main aspects of this procedure is safety and environmental control. This is to control occurrence of injuries as well damages to any equipment and properties during the entire works period and also to make other provision as required to safe guard against any hazard that are involved in the work or during the preparation stage. The following safety measure shall be implemented in order to ensure a safe working environment during the entire concreting work.

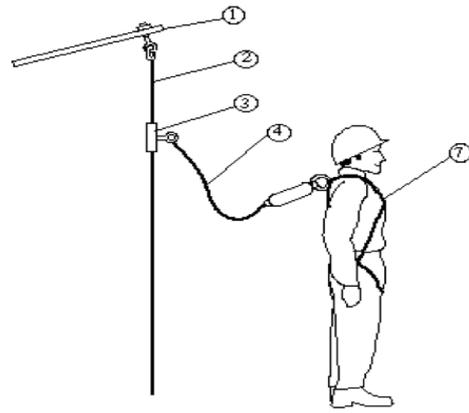
#### **18.5.5 Machinery and Equipment (Refer to Chapter 24 Machinery and Equipment)**

- a) All work shall be carried out under the direction of an experienced supervisor.
- b) All operators and driver must be equipped with valid driver / operator licenses or permit from the relevant government agency.
- c) Prior to using any machineries / equipment at site, it shall be inspected by a machinery supervisor.
- d) Periodic preventive maintenance shall be carried out all equipment and machineries.
- e) Only authorized signalman shall be assigned together with the operator or driver.





External working platform



Fall protection against edge of the building



Heavy duty working platform

# **CHAPTER 18**

## **PAINTING WORK**

## **Chapter 18 Painting Work**

### **18.1 Introduction**

Painting is one of the work processes commonly carried out in construction industry. The common methods of application are by means of brush/roller or spraying. In spray painting, the paint fluid is first 'atomized' or broken into small droplets before it is applied to the surface to be coated. Normally paints are thinned by the addition of solvents to reduce its viscosity. Nearly all solvents have flash points below ambient temperature. During painting, solvent vapors are being continuously liberated to the surrounding atmosphere and can attain dangerous concentrations which may explode in the presence of an ignition source. So, it is of paramount importance that when painting is carried out inside confined spaces, the spaces are well ventilated and all ignition sources removed

Fibber floor coating application of epoxy resin is equally hazardous as spray painting processes due to its toxicity, flammability and it is more volatile which will rapidly vaporizes of its content upon expose to air, it is important to ventilate the entire area of the floor coating activity to dilute the contaminant to sustainable a safe level throughout the curing period.

Spray painting & fiber coating use of epoxy resin can only be carried out in the construction site upon obtaining a permit for the same. A painting permit is also required for brush or roller painting inside confined space.

### **18.2 Objective**

To ensure the safety of all workers or any person involve in the paint work to follow this guideline. Painting Works for Exterior Walls, Interior Walls, Concrete Floor, Exposed Ceiling/Slab Soffit, Cable Room and Below Raised Floor

### **18.3 Definition**

A painting is an image (artwork) created using pigments (color) on a surface (ground) such as paper or canvas. The pigment may be in a wet form, such as paint, or a dry form, such as pastels.

## **18.4 Legal Requirements**

### **Occupational Safety and Health Act 1994,**

- a) Classification, Labelling and Safety Data Sheet of Hazardous Chemical. (REG2013)
- b) Use and Standards of Exposure of Chemical Hazardous to Health. (CHRA Report).REGULATION 2000(USECHH REGULATION)
- c) Section 15(2) (c): “Information, instruction, training and supervision”
- d) Section 24: General duties of employees at work;

### **Factories and Machinery Act 1967,**

- a) Factories and Machinery (Safety, Health and Welfare) Regulations, 1970, Regulation 12: Working at Height
- b) Factories and Machinery (Building Operation and Works of Engineering Construction) (Safety) Regulations, 1986

## **18.5 Procedure**

### **18.5.1 General Safety**

In general, the schedule of painting works should be planned in relation to the work of other trades, so as to ensure that the surfaces to be painted are prepared on time and that the subsequent construction works will not damage the paint work.

Hazards include:

- a) Trip and Fall height
- b) Fire Explosion
- c) Drop of Materials.
- d) Spill of paint.
- e) Repetitive movement

Painting worker shall wear correct type of safety shoes, body harness, and glove and mask (Refer to CHRA Report) before start work. **(Refer to Chapter 21 PPE).**

## **18.5.2 Types of Paint**

### **a) Primers / Sealers:**

- i. These coatings are designed to provide the surface for the finish coats of paint or clear finishes.
- ii. Primers seal the surface off and provide a “tooth” for the finish paint, they are used on bare wood and metal, previously painted surfaces that have been repaired or are in poor condition, or if the existing surface is to be painted with a new colour that is much darker or lighter than the existing. Primers/Sealers are also used block out stains like water stains, crayon, smoke, soot, ink and on woods that will bleed through a paint coating.
- iii. Primers/Sealers insure longer lasting paint work as the resins in the finish paints stay on the surface creating the “wear layer” as they are designed to do. Peeling and premature failure is eliminated and this is by far the most important part in getting a long lasting, durable finish.

### **b) Finish Paints:**

- i. There are two types of paints used today, latex and alkyd. Alkyd paint is also known as oil-based paint. Latex provides an excellent finish, while being an easier paint to use. Latex paint cleans up with soap and water, dries quickly, is non-flammable, easy to touch up, they remain more flexible and allow moisture to evaporate through the film thus reducing blistering, cracking and peeling.
- ii. Inexpensive latex paints use softer vinyl resins (binders) and more water in the formulation while the more durable of the latex paints use 100% acrylic resins and less water. The term “Enamel” is normally associated with paints that have some gloss to the finish. Enamels are formulated with higher concentrations of resin as they are intended to be subjected to more wear and tear.

### **c) Levels Of Gloss:**

- i. The sheen of paint is the amount of light reflected by the surface of a paint finish. There are four basic sheens: flat, satin, semi-gloss and gloss.
- ii. Flat Paints exhibit non-reflective properties providing a matte finish. This finish helps hide surface imperfections, and is normally used for ceilings and walls in areas not subjected to a lot of wear and tear, dining rooms, living rooms and bedrooms not used by small children.

- iii. Satin Finish also known as eggshell finish, provides a soft lustre sheen similar to that of an eggshell. A satin finish provides a harder surface finish which is more durable and more stain resistant than a flat finish. This durability makes satin paint a good choice for walls in children's rooms, hallways, stairways and family rooms.
- iv. Semi-gloss Paints are very durable, they are easier to clean, and are more stain resistant than satin finish paints. Semi-gloss paints are most often used on heavy wear surfaces or areas that are frequently cleaned such as kitchens and bathrooms. Semi-gloss paint is also used on wood trim and cabinets.
- v. Gloss Paint is a harder, more durable, more stain resistant paint finish. It is easier to clean than all the other paint finishes. Gloss finishes generally make surface imperfections more noticeable. Gloss finishes are the best choice for heavy wear areas like kitchens, bathrooms, furniture and cabinets, floors, stairs, handrails, high traffic doors and trim.

### **18.5.3 Spray Painting**

#### **a) Spray Paint**

Spray painting is the least costly of the three primary methods – brush, roller and spray – and it is the fastest application method. The more irregular the space being painted, the greater the advantage of spray over other methods.

- i. Stay out of heat and away from fire.
- ii. Make sure to keep away from heat, sparks and open flame. Don't smoke. Extinguish all flames, pilot lights and heaters. Turn off stoves, electric tools and appliances, and any other sources of ignition.
- iii. Avoid prolonged exposure to sunlight or heat from radiators, stoves, hot water and other hot items that may cause bursting. Additionally, for best finish, spray paint directly in hot, humid weather.
- iv. Ventilate.
- v. Vapours are harmful; avoid continuous breathing of spray mist by spraying outside whenever possible. When spraying inside, open windows and doors to ensure fresh air entry during application and drying. Wearing respiratory protection is also helpful – most hardware stores sell a variety of painting masks.
- vi. Avoid contact with your eyes and skin. Wear gloves or wash your hands after using.

- b) Take the following precautions when painting lighting and electrical fixtures:
- i. Inspect electrical cords for any damage that could come into contact with unwanted paint or overspray.
  - ii. Do NOT paint wiring.
  - iii. Do NOT paint light bulbs.
  - iv. Do NOT paint damaged cords which may have exposed wiring.
  - v. Do NOT paint parts of fixtures that get excessively hot, unless using a High Heat paint specified for that purpose.
- c) Take the following precautions when painting objects in contact with open flame (candle holders, fire pits, etc.)
- i. Do NOT paint in the vicinity of an open flame.
  - ii. Do NOT paint any surface that will be in contact with an open flame, especially the insides.
  - iii. Do NOT leave open flames unattended in any situation.
  - iv. If using High Heat paint, read back of product label to ensure expected heat is within the recommended temperature ranges of the paint.

#### **18.5.4 Safety Requirements to be provided by the Applicant**

- a) The safety data sheet (SDS) for the paint, solvents etc. in use to display at the storage and work area conspicuously.
- b) Adequate Fire Extinguisher shall be provided and placed within painting vicinity.
- 1) Enclose space
    - i. Prominent displaying of appropriate signboards at the storage area and including the space where the process is intended to take place.
    - ii. Cordon off the storage area and the area of process.
    - iii. Supplying of sufficient forced and exhausts ventilation.
    - iv. Ensure no hot work in the space and the area of process.
    - v. Provide adequate flameproof lights with cables in good condition in enclosed space.
    - vi. Ensure suitable cartridge type respirators are used by workmen appropriately.
    - vii. Provide containment tray for storage of paint and epoxy resin.
    - viii. Receptacles or waste and empty containers to be dispose by license contractor according to disposal of schedule waste as per statutory requirement.
    - ix. Adequate ventilation must be maintained during the curing period as well.

## 2) Open Space

- i. Prominently display appropriate signboards and cordon off at the storage area and process area.
- ii. Ensure suitable cartridge type respirators are used by workmen.
- iii. Provide containment tray for storage of paint and epoxy resin.
- iv. Supply of sufficient forced ventilation.
- v. Receptacles or waste and empty containers to be dispose by license contractor according to disposal of schedule waste as per statutory requirement.

### **18.5.5 Safety**

The contractor shall also be responsible for all injury to persons or damage to property that occurs as are sult of the contractor's negligence and shall take proper safety and health precautions to protect the work, the workers, the public, and the property of others. The contractor shall be responsible for all materials delivered and work performed until completion and acceptance of the entire work.

The contractor shall perform all its activities pursuant to this contract in a safe manner. The contractor hall assume responsibility on the job site for the actions of all its personnel and subcontractor(s) who are associated with performance on this contract. The contractor shall take adequate measures to prevent injury to the public or Authority property on the job site.

#### a) Fire Prevention

The contractor shall be knowledgeable and train all its employees on the procedures and means of egress as well as the methods of reporting fires on the job sites.

#### b) Smoke Free Environment

The Authority's facilities are smoke free. The contractor and its employees shall adhere to all applicable rules and regulations regarding maintenance of a smoke free environment on the job sites.

#### c) Refer to SDS before start work.

#### d) Storage of Material

- i. These are properly labelled on both the material and the storage area to indicate the material status at all times.
- ii. Store material in a cool, well ventilated and dry place, away from direct sunlight.

- iii. Ensure adequate ventilated application.
- iv. Avoid contact with skin or eyes. Any skin or eye contamination should be washed immediately with plenty of water and seek medical treatment.
- v. If swallowed, seek medical advice immediately. Do not induce vomiting.
- vi. Keep away from heat sources.
- vii. All materials are under the responsibility of the material controller and the supervisor on duty at each of the floor level.
- viii. All material must be collected and returned to the designated storage area after working hours and properly secured and locked.

	
<p>To remove foreign and unstable matters such as construction soot, concrete/cement splashes.</p>	<p>Sanding/grinding/skim coating Followed by rinsing with clean Water and wiping dry</p>
	
<p>Manual cleaning by chipping, scraping and/or wire brushing</p>	<p>Window Protection</p>



Floor, Sliding Door Frame and Railing Protection



External Painting work



External Painting work

# **CHAPTER 19**

# **WINDOW FRAME AND GLASS INSTALLATION**

## Chapter 19 Window Frame and Glass Installation.

### 19.1 Introduction

A window is an opening in a wall, door, roof or vehicle that allows the passage of light, sound, and air. Modern windows are usually glazed or covered in some other transparent or translucent material, a sash set in a frame in the opening; the sash and frame are also referred to as a window. Many glazed windows may be opened, to allow ventilation, or closed, to exclude inclement weather. Windows often have a latch or similar mechanism to lock the window shut or to hold it open by various amounts.

### 19.2 Objective

The purpose of this Work Method Statement to ensure safe work environment and prevent from accident.

### 19.3 Definition

Window can be fabricated from a variety of materials, for example, timber, plastic, metal, etc. It is a system and comprises various components as follows

- a) **Active Panel** - Primary operating door panel.
- b) **Aluminium Surround** - The aluminium frame around a screen or energy panel
- c) **Awning Window Unit** - A combination of frame and sash, hinged at the top of the vertical jambs which allows the unit to pivot from the top with the sash opening to the exterior of the building.
- d) **Blind stop** - The frame member on a double hung window located between the jambs and the casing. The blind stop forms a rabbet that supports either a storm sash or screen.
- e) **Depth of the Jamb** - The point where the exterior casing ends to the point where the interior casing begins. On clad units, the point from the backside of the nailing fin to the interior of the frame.
- f) **Sash Lock** - A locking device which holds a window shut, such as a lock at the check rails of a double hung unit. Larger units utilize two locks.

### 19.4 Legal Requirements

FMA BOWEC: Regulation 8. Slipping Hazards.

Regulation 9. Tripping and Cutting Hazards.

Regulation 13. Eye Protection

Regulation 16. Electrical Hazards

## **19.5 Procedure**

### **19.5.1 General Safety**

To ensure that all the necessary preparation needed will be handled in the early stage and anticipate problems that may later arise.

**Hazards include:**

- a) Falling from height.
- b) Struck by falling object
- c) Caught in between objects
- d) Electrical Shocks.
- e) Hand, foot and
- f) Body injury

Window install worker shall wear correct type of safety shoes, body harness, and glove before start work. **(Refer to Chapter 21 Personal Protective Equipment and Chapter 15 Working height.)**

### **19.5.2 Installation of Window Frame and Glass Safe Precaution.**

- a) A competent and experienced site supervisor will be appointed to manage and oversee the works, including on-site health and safety.
- b) All operatives are to receive information and instruction on the content of this method statement and the attached risk assessments. All operatives are to receive a site safety induction prior to the commencement of works.
- c) All operatives using power tools are to have received suitable and sufficient training in the use of the equipment. Only those considered competent to use such equipment shall be permitted to operate such tools.
- d) All operatives are to receive training on safe manual handling techniques and asbestos awareness.
- e) All operatives are also to receive training in safe working practices for work at height including the safe use of safety harnesses.
- f) Due to the nature of the site, all external working areas immediately below and around where the windows are to be replaced are to be securely fenced off at ground level using Her as fencing to prevent any unauthorized persons entering the working area, this will also provide protection against any falling terms during the works. Warning sign will also be erected to advise and inform others of the hazard.
- g) Before starting work ensure that the correct window sizes have been supplied, together with the necessary fixtures and fittings.

### 19.5.3 Sub-frame System

The sub-frame system comprises a sub-frame which is either cast in or anchored to the wall. The main frame is then installed onto the sub frame at a much later stage of the construction.



Positioning of sub-frame using ride up blocks or aluminum shin plates



Installing temporary stiffener for sub-frame



Protection Tape.

#### **19.5.4 Installation of Frame on Precast and Cast-in Situ RC Walls**

- a) Should be provided to accommodate the installation of the straps/brackets.
- b) These recesses should be provided during the casting of the RC walls and in accordance with the specified spacing of the straps/ brackets.

#### **18.5.5 Installation of Window and Glass**

It is recommended that glazing work for inner glass panels be carried out in the factory, where higher work quality can be achieved. Where this is not possible, glazing work must be carried out on site with proper handling and good workmanship. For fixed glass panels, glazing is usually done on site.



Window Glass Installation



Insertion of spacer blocks



Insertion of gasket



Fixing of handles

# **CHAPTER 20**

## **ROOFING WORK**

## Chapter 20 Roofing Work

### 20.1 Introduction

Employers should liaise among themselves to provide an integrated fall protection method for all persons working on the roof. This should be less hazardous and more economic than every contractor installing their own system. See other sections of this guide for relevant information.

### 20.2 Objective

To ensure the safety of all workers or any person involve in the roofing work to follow this guideline accordingly for the prevention of fall at workplace.

### 20.3 Scope

- a) General Safety
- b) Roof and Roof Plant Maintenance
- c) Access
- d) Edge Protection
- e) Safety Mesh
- f) Hoisting Roofing Materials
- g) Brittle Roofing

### 20.4 Legal Requirements

These best practice apply to work carried out from 2 meters or more in height, in place of work. They will assist those with responsibilities under the Factories and Machinery Act 1967 (Act 139) and Occupational Safety and Health Act 1994 (Act 514) to prevent falls.

This guideline includes relevant sections of the Act and Regulations, namely:

- **Occupational Safety and Health Act 1994,**
  - a) **Section 15:** General duties of employers and self-employed person to their employee
  - b) **Section 15(2) (c):** "...Information, instruction, training and supervision..."
  - c) **Section 17:** General duties of employers and self-employed persons to persons other than their employees.
  - d) **Section 20:** General duties of manufacturers, etc. as regards plant for use at work.
  - e) **Section 24:** General duties of employees at work.

- **Factories and Machinery Act 1967,**
  - a) Factories and Machinery (Safety, Health and Welfare) Regulations, 1970, Regulation 12: Working at Height
  - b) Factories and Machinery (Building Operation and Works of Engineering Construction) (Safety) Regulations, 1986

## **20.5 Procedure**

### **20.5.1 General Safety**

Employers should liaise among themselves to provide an integrated fall protection method for all persons working on the roof. This should be less hazardous and more economic than every contractor installing their own system. See other sections of this guide for relevant information.

#### **Hazards include:**

- a) Brittle roofing such as skylights or translucent sheets;
- b) Roof surface, slippery surface from roll form dress, paint finishes or dew and rain;
- c) Roof pitch and projections such as pipework and flashings;
- d) Any roof opening/penetration larger than 600 mm by 600mm
- e) Any roof edge.

Person on a roof shall wear the correct type of footwear to grip the roof surface. Natural rubber; flexible-soled shoes are usually best.

#### **As a minimum standard for all roof areas:**

- a) For areas that do not have a fall-protection barrier, a fall-arrest system shall be used;
- b) For surface that have a fall-protection barrier and provide a secure footing, and edge-protection system, travel-restriction system or fall-protection system shall be used;
- c) For all roof area that do not have a fall-protection barrier or secure footing, a fall-protection system shall be used.

On completed roofs or where persons are kept more than 2 meters from any fall hazard by a bump rail, edge protection may be unnecessary. A bump rail consists of a rail or tensioned rope supported on posts at a height of 1.0 meters.

Note: A bump rail shall not be used on a roof of greater than 5 degree pitch.

Where a bump rail is not practical, edge protection, travel restriction systems, or a fall-arrest system shall be used. Edge protection can include scaffolding or a guardrail system.

The ability of a surface to provide a secure footing will vary depending on the roofing material, environmental conditions and the type and condition of the roofer's footwear.

### **20.5.2 Roof and Roof Plant Maintenance**

Where regular maintenance of plant or equipment needs to be carried out on roofs, ramps, crawl boards, access ladders should be installed and comply with Section 3: Permanent Fixed Access and Platforms.

#### **Brittle roofing is a major hazard and cause of serious harm:**

- a) Translucent and brittle roofing materials may have weathered to become almost indistinguishable from their surroundings.
- b) Brittle areas may have been painted to match the rest of the roof.
- c) Corrosion because of age or chemicals in the building can impair roofing material so it can no longer support the weight of employees.

All roofs should be treated as brittle until a close inspection reveals otherwise.

Roofs that need regular cleaning or maintenance and that provide secure footing should be fitted with permanent perimeter protection and access ladders. Any skylights or other brittle areas in such roofs should have safety mesh or strong covers fitted under or over them, or guardrails fitted around each side of the suspect area.

A bump rail may be used provided it is successful in keeping all people at least 2.0 meters away from the brittle areas.

Where an employee is required to work closer than 2 meters to the edge of any roof or from where a fall is possible, fall protection or edge protection must be provided.

As a minimum standard on roofs from which a person may fall 2 meters or more:

- a) On completed roofs that provide a secure footing, edge protection, fall protection or bump rails 2 metres from the edge shall be used.
- b) On roofs that do not provide secure footing, or are steeper than 30 degrees, fall protection, work positioning systems or permanently installed access and platforms shall be used.

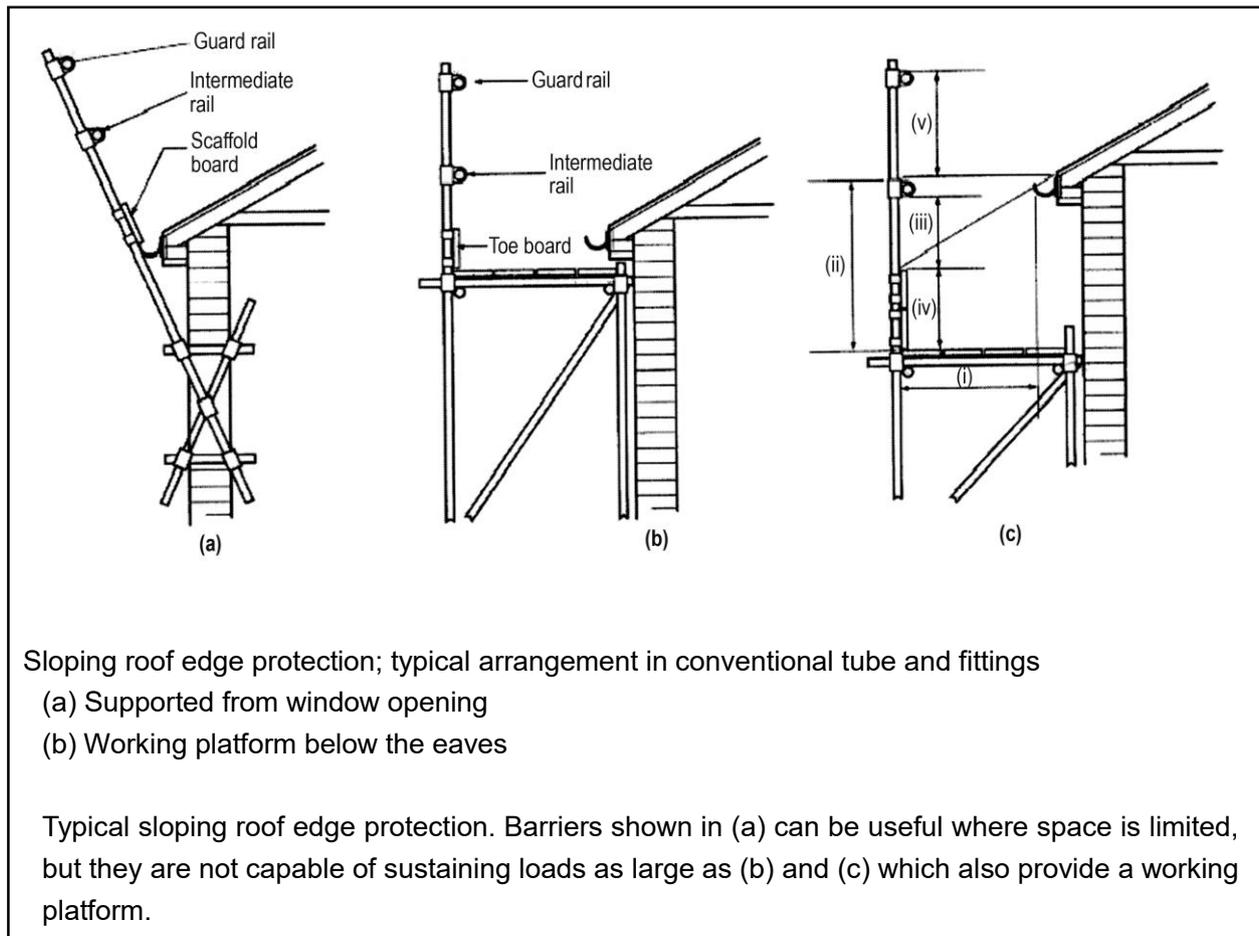
	
<p><i>Severe deterioration of roofing materials may not be readily apparent from the upper surface. Inspect the underside of brittle roofing materials for hazards</i></p>	<p><i>Danger signs to be fixed at points of access to the roof</i></p>

### 20.5.3 Access

Safe access must be provided to all roof areas where work is to be carried out. Such access must take into account the tools or equipment that need to be carried up. Ladder towers are preferable to ladders. Ladders are not sufficient where persons are expected to use their hands to carry materials up onto the roof. Ladders must be secured to prevent displacement sideways and slipping out from the base. All access equipment must comply with the relevant accepted international Standards.

### 20.5.4 Edge Protection

Full edge protection at eaves level will normally be required for work on sloping roofs. The edge protection needs to be strong enough to withstand a person falling against it. The longer the slope and the steeper the pitch the stronger the edge protection needs to be. A properly designed and installed independent scaffold platform at eaves level will usually be enough. Less substantial scaffolding barriers (rather than platforms) may not be strong enough for work on larger or steeper roofs, especially slopes in excess of 30°.



***Edge Protection on slope roof(RECOMMENDATION)***

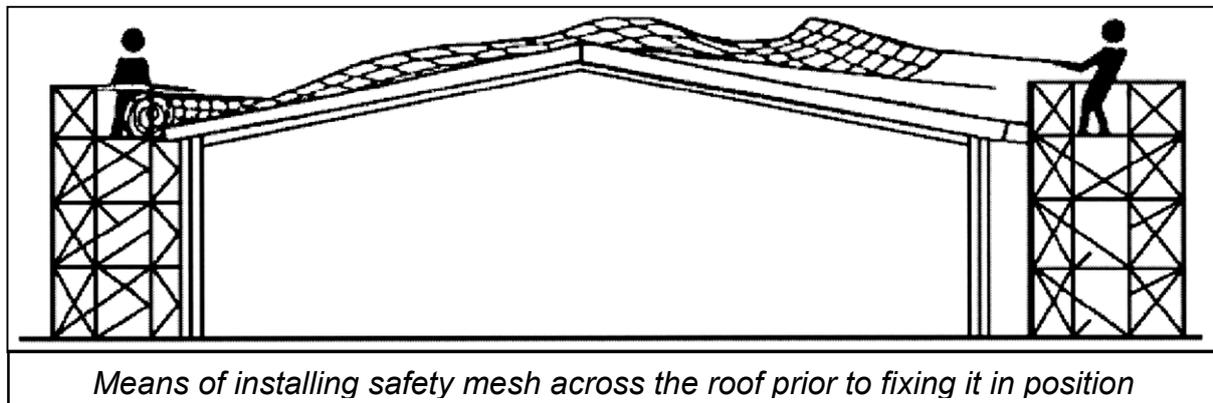
On some larger roofs, the consequences of sliding down the whole roof and hitting the eaves edge protection may be such that intermediate platforms at the work site are needed to prevent this happening.

If the work requires access within 2 m of gable ends, edge protection will be needed there as well as at the eaves.

Powered access platforms can provide good access as an alternative to fixed edge protection. They can be particularly useful in short duration work and during demolition when gaps are created in the roof.

### **20.5.5 Safety Mesh**

Safety mesh shall comply with accepted international Standard in both its manufacture and installation.



When correctly installed, safety mesh will provide a fall-protection barrier for roof workers at the time of construction and for future maintenance workers where the roof contains skylights or other brittle roofing. It may be fixed over Roof penetrations to prevent the need for guardrails.

Edge protection and safety mesh provides an enclosed work environment. Mesh should be pulled over the roof by ropes or other methods, otherwise a fall-arrest system will be needed during its installation.

### **20.5.6 Hoisting Roofing Materials**

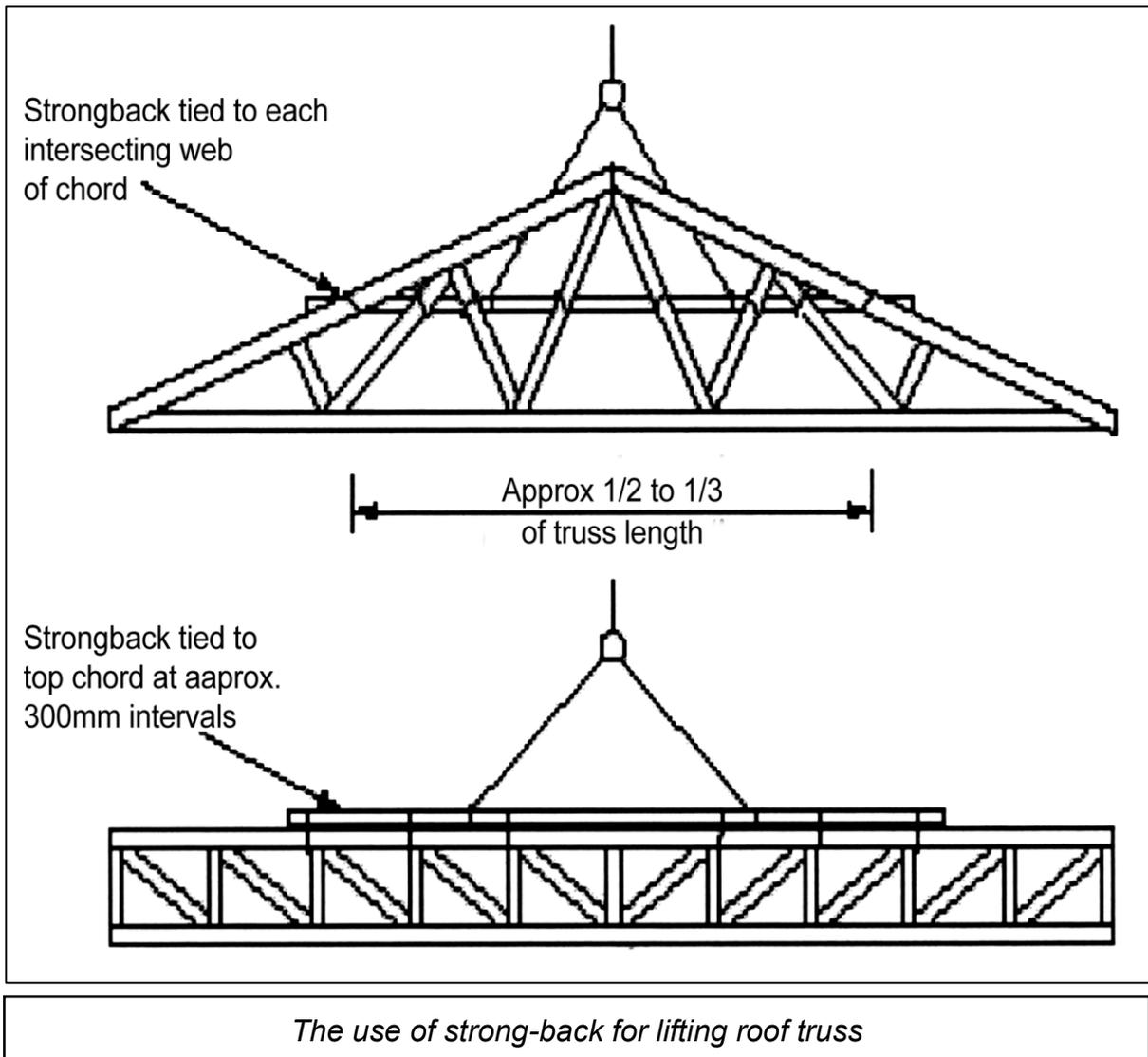
Bundles of roofing materials should be placed evenly along the roof to reduce the need for 'walking' the sheets. When hoisting a bundle of roofing, workers receiving it on the structure must have safe mobility to avoid the load. Short lanyards that restrict movement may not be acceptable.

Where safety mesh is fitted, roofers should keep at least 2 meters from any perimeter edge unless restriction systems or edge protection is in place.

All bundles should be securely banded while being lifted by a crane. Tag lines should be used to control the swinging of the bundles while they are out of reach.

Wearing leather gloves while moving sheets or bundles will reduce cut and slash injuries.

Long lengths should be lifted using a strong-back, particularly if being lifted by a hoisting machine or crane.



### 20.5.7 Concrete and Clay Tile Roofing

Tile battens may be used as fall protection barrier provided they are placed in such a manner that the workers may not fall through and of sufficient strength to span roof framing members. Battens may provide a safe platform for the batten fixer provided that work starts at the lowest point and moves up the roof. Care shall be taken to work or walk on the battens over the supporting framework to eliminate the possibility of failure. Where the roofer needs to walk up the roof framing before battens are fixed, fall protection should be provided.

Roofs of under 30 degrees will generally provide secure footing subject to the correct footwear being worn. This allows the tiller to place tiles while standing on a lower row. On roofs over 30 degrees, it is often possible for the tiles that are not fixed to be slid up under the one above, thus forming a series of penetrations that can be used as footholds for access up the roof. This allows the placing and pointing of ridge tiles, etc. If this is not possible, a work-positioning system will be required.

Where tile battens or tiles provide a fall protection barrier; edge protection is necessary if a fall of more than 2 meters is possible.

### **20.5.8 Brittle Roofing**

- a) Protection from falling through a brittle roof shall be provided. Before working on any roof, employers and self-employed persons need to inspect the roof from its underside for structural soundness. Skylights of matching roof profile are a particular hazard as they may weather or be painted and so match the surrounding roof areas.
- b) A common belief exists that it is safe to walk along the line of nail heads or roof bolts above the purlins. In reality; this is similar to walking a tight rope.
- c) Fall protection shall be provided where roofing material is brittle, corroded, and no fall-protection barrier is installed.
- d) Where only part of the roof area is brittle, i.e. skylights, such areas shall be treated as penetrations with secure covers or guardrails.
- e) Where persons walk along internal gutters, such gutters must be 450 mm wide or fall protection should be provided.

### **20.5.9 Temporary Working, Equipment and Facilities Protection Shed**

The Overhead Protection Shelter are as per below:

- a) Rebar Fabrication Yard
- b) Wooden Fabrication Yard
- c) Protection Shelter electrical Distribution Box
- d) Protection Shelter for Tower Crane Equipment
- e) Protection Shelter for others Facilities

Remarks, **refer to Chapter 4 Overhead Protection Shelter**



# **CHAPTER 21**

# **PERSONAL PROTECTIVE EQUIPMENT (PPE)**

## Chapter 21 Personal Protective Equipment (PPE)

### 21.1 Introduction

Personal Protective Equipment (PPE) is clothing or equipment designed to protect the wearer (employee, contractors or visitors) against workplace hazards. PPE should only be considered when the hazard cannot be eliminated or where the risk cannot be controlled using other methods from the hierarchy of controls (Substitution, Isolation, Engineering, Administration and PPE). PPE is the least effective control measure because the hazards and risks are still present. There are also issues of proper fit and design for different individuals. PPE can sometimes be awkward, uncomfortable and limiting, which may make workers less likely to use such equipment.

### 21.2 Objective

This guideline outlines the requirements and practices for the management of PPE to assist with the correct selection, supply, use, replacement, maintenance, training, instruction and storage. These best practice apply to all employees irrespective of their work location.

### 21.3 Definition

- a) **Personal Protective Equipment (PPE)** - Safety clothing or equipment for specified circumstances or areas, where the nature of the work involved or the conditions under which people are working, requires it's wearing or use for their personal protection to minimise risk.

### 21.4 Legal and Other Requirements

- a) Occupational Safety and Health Act 1994
  - i. **Section 15** - General Duties of Employers and self-employed person to their employees
  - ii. **Section 24(1)(c)** - *General duties of employees at work*; to wear or use all times any protective equipment or clothing provided by the employer for the purpose of preventing risks to his safety and health.

b) Factories and Machinery Act 1967

- i. **Section 24** - Where in any factory persons are exposed to a wet or dusty process, to noise, to heat or to any poisonous, corrosive or other injurious substance which is liable to cause bodily injury to those persons the Minister may prescribe the provision and maintenance for use of those persons suitable and adequate personal protective clothing and appliances including where necessary goggles, gloves, leggings, caps, foot-wear and protective ointment or lotion.

c) Safety, Health and Welfare Regulations 1970

- i. **Regulation 12 - Working at Height**; where any person is required to work at a place from which he will be liable to fall a distance of more than ten feet, means shall be provided to ensure his safety and such means shall where practicable include the use of safety belts or ropes.
- ii. **Regulation 32** - Working, clothes, personal protective clothing and appliance. Follow all requirement under this Regulation.

d) Building Operation and Works of Engineering Construction (BOWEC), 1986

- i. **Regulation 13 - Eye Protection**; Suitable eye protection equipment shall be provided by the employer and shall be used by employees while engaged in welding or cutting operations or in chipping, cutting or grinding any material from which particles may fly, or while engaged in any other operation which may endanger the eyes.
- ii. **Regulation 14 - Respirators**; Where these Regulations require respirators to be provided, the employer shall provide and the employee shall use a respirator suitable for the type of operation for which it is to be used. The employer shall maintain such respirator in good repair and shall furnish the means for its continued efficient working condition; and he shall provide regular inspection, cleansing and sterilisation of such equipment when not in use shall be stored in closed containers.
- iii. **Regulation 15 - Protective Apparel**, All applicable under this regulation and sub-regulation 15(1), 15(2), 15(3), and 15(4).
- iv. **Regulation 24 - Use of Safety Helmet**; all persons who are performing any work or services in a worksite shall wear safety helmets.
- v. **Regulation 50 - Safety Belts**; Safety belts, life lines and all devices for the attachment of life lines shall be adequate strength and of a type approved by the Chief Inspector.
- vi. **Regulation 51 - Attachment required**; all applicable under this regulation and sub-regulation 51(1), 51(2), 51(3), and 51(4).

- vii. **Regulation 52 - *Instruction in Using Safety Belt***; Every employee who is provided with a safety belt shall be instructed in the proper method of wearing and using it, as well as attaching it to the life line.
- viii. **Regulation 53 - *Protection of Life Lines***; Padding, wrapping or similar means shall be provided to protect every life line from contact with edges or objects which may cut out or severely abrade it.
- ix. **Regulation 54 - *Inspection of Safety Belt***.
  - Every safety belt and every life line shall be inspected by designated persons before use by an employee.
  - No employer shall suffer or permit an employee to use a safety belt or life line which shows any indication of wear, damage or deterioration likely to affect its strength and no such belt or life line shall be kept on the worksite

## 21.5 Procedure

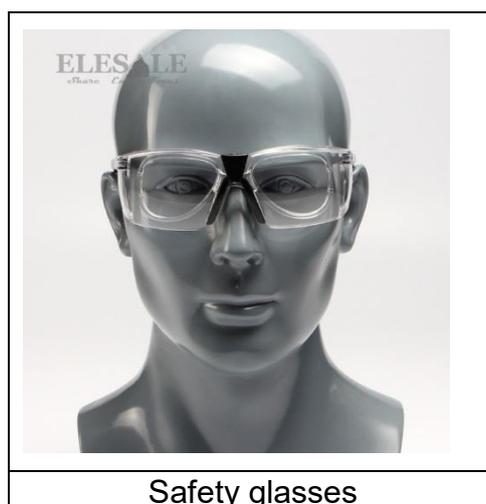
### 21.5.1 Head Protection (Safety Helmet)

- a) Safety helmet, of an approved type (Meet Sirim Standards) must be worn at all time on the site. Safety helmet must have identification markings such as company's name
- b) Safety helmet is not required to be worn in the canteen, rest area, driver's cab, office area and any other areas where exemption is granted.
- c) Welder shall wear safety helmet with face shield attachment.
- d) Shell or suspension should not be altered or modified.
- e) Bump cap shall not be worn at the site.
- f) Issue of safety helmet must be documented and records be maintained.
- g) Safety helmet colour code to adhere:
  - i. **Red colour** - for project site safety supervisor, safety and health officer, project manager, and visitor;
  - ii. **White colour** - for project management team:
  - iii. **Yellow** - colour for site workers;
  - iv. **Blue colour** - for specialist workers.eg signal man and flagman



### 21.5.2 Eye Protection (Safety Glass)

- a) Eye protection must be worn when doing works such as welding, cutting, chipping, grinding, chemical splashes and other works that particles or fragments may fly and risk injury to the eyes.
- b) Minimum requirement for safety glass is Z287+
- c) Person engaged in the above works must wear the appropriate goggles, safety spectacles and face shield.
- d) Person engaged in electric arc welding, cutting or other similar operation must wear welder's shield.
- e) Issue of safety glass must be documented and records be maintained.



### 21.5.3 Hearing Protection

- a) Person carrying out work which generates noise above 82 decibels-(A) must wear ear protection during working.
- b) Person working in area where noise level exceeds 82 decibels-(A) must also wear ear protector.
- c) Ear protectors must be made available by subcontractor for use in areas with noise level above 82 decibels-(A).
- d) For noise levels exceeding 115 decibels-(A), ear muff must be worn.
- e) Person-in-charge of the work or area shall determine the noise level through measurements.
- f) Issue of hearing protector must be documented and records be maintained.



### 21.5.4 Respiratory Protection

- a) Respirators must be used if dangerous fumes are liable to be present or supply of air is inadequate or likely to be reducing to be inadequate for sustaining life.
- b) Mask must be worn for processes that generate dust, gas, or vapour.
- c) Respirator must examine at least once a month by competent person.
- d) Respirators must be maintained regularly and stored as specified by manufacturer.
- e) Issue of respirator must be documented and records maintained.

	
<p>Particulate Mask for protection against dust and debris</p>	<p>Respirator with R95 Cartridge Protection against fumes</p>

### 21.5.5 Hand Protection (Glove)

- Gloves must be selected accordingly to the type of hazards.
- Suitable gloves must be used to protect hands against chemical, mechanical, thermal, electrical, radiation and biological hazards.
- PVC gloves must be worn when handling corrosive substances.
- Discarded and contaminated gloves must be destroyed.
- Gloves must be maintained regularly and stored in a designated area.
- During work with any rotating machinery, no gloves are allowed.
- Issue of gloves must be documented and records be maintained.



### 21.5.6 Fall Protection

- a) Workers at height and elevation of 3 meters on temporary platform must be secured by safety harness with proper attachment.
- b) Safety harness must be securely attached to anchorage and shall not be longer than it required.
- c) Safety harness must be fitted with two receptacles and bolt bag when climbing on temporary structure.
- d) Bolt bag belt fitting must be sufficient to enable the climber to carry all loose equipment and have both hand free for climbing.
- e) Padding, wrapping or similar means must be used to protect every lifeline from contact with edges and objects which may cause abrasions, cut or severely damage the lifeline.
- f) Damage safety harness or lifeline must not be used.
- g) Safety harness must be cleaned and examined with safety harness checklist.
- h) Issue of safety harness must be documented and records be maintained.



Safety harness



Safety harness training

### **21.5.7 Foot Protection**

- a) Safety shoes must be worn at site
- b) Water proof safety shoes must be worn when working in water, wet concrete or other wet footing
- c) Safety shoes must be properly worn and maintained.
- d) Issued of safety shoes must be documented and records be maintained.



### **21.5.8 Safety Reflector Vest: High Visibility for Safety**

- a) Safety reflector vest must be worn at site
- b) Safety reflector vest is keeping an employee visible in working conditions with less than optimal lighting
- c) Safety reflector vest must be properly worn and maintained
- d) Issued of safety reflector vest must be documented and records be maintained



**APPENDIX 1 ISSUE OF PPE RECORD**



**Giant Leap Construction Sdn. Bhd.**

**ISSUE OF PERSONAL PROTECTIVE EQUIPMENT (PPE) RECORD**

S/No	Name of Worker	NRIC/ PP No.	PPE Issued					Workers			
			Safety Helmet	Safety Harness	Safety Shoes	Ear Plugs	Safety Glasses	Masks	Signature	Date	
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											

Note: This record shall be kept properly at the site office for checking

Company Name : \_\_\_\_\_  
 Name of Site Supervisor : \_\_\_\_\_  
 Signature : \_\_\_\_\_

# **CHAPTER 22**

## **SIGNAGE, TAGS AND BULLETIN BOARD**

## Chapter 22 Signage, Tags and Bulletin Board

### 22.1 Introduction

The purpose of a system of safety colors and safety signs is to draw attention to objects and situations which affect or could affect health or safety. The use of a system of safety colors and safety signs does not replace the need for appropriate accident prevention measures.

### 22.2 Objective

- a) For giving information for use in the prevention of accidents, for warning of health hazards and for meeting certain emergencies. Examples of safety signs having particular meanings.

### 22.3 Definition

For the purposes of this standard the following definitions shall apply.

- a) **Safety colour** - A colour to which a specific health or safety meaning or purpose is assigned.
- b) **Contrasting colour** - A colour that contrasts with the safety colour in order to make the latter more conspicuous.
- c) **Symbol** - A pictorial representation used on a safety sign.
- d) **Safety sign** - A sign that gives a message about health or safety by a combination of geometric form, safety colour and symbol or text (i.e. Words, letters, numbers) or both.
- e) **Prohibition sign** - A safety sign that indicates that certain behaviour is prohibited.
- f) **Warning sign** - A safety sign that gives warning of a hazard.
- g) **Mandatory sign** -. A safety sign that indicates that a specific course of action is to be taken.
- h) **Safe condition sign** - A safety sign that provides information about safe conditions.
- i) **Supplementary sign** - A sign with text only that may be used in conjunction with a safety sign in order to provide additional information.

## 22.4 Legal and Other Requirements

- a) Occupational Safety and Health Act 1994
  - i. Classification, Labelling and Safety Data Sheet Regulation 2013
- b) Factories and Machinery Act 1967
  - i. Building Operations and Works of Engineering Construction (Safety) Regulation 1986 (BOWEC)
    1. Regulation 23 – *Numbering and Marking of Floor*, Each floor of every building under construction shall be appropriately numbered or marked at the landing at every floor of every staircase or other means of access.
    2. Regulation 48 – *Danger Sign*, A simple but effective warning notice in the national language shall be placed in a conspicuous position at the discharge end of every chute to warn the employees and public.
- c) Other Requirements
  - i. Related safety signage or information Board shall be placed on the main entrance in the construction site. *See photo 1.*
  - ii. Any Safety signage and information board shall meet the actual needs of the construction site and meet the local authorities requirements
  - iii. A major hazard source at the construction site are required to display at Safety Information Board which should give clear indication of the dangerous source, type of risk and also can add in the construction time, current progress, organizational framework, etc. for additional information of the project.
  - iv. Scaffolding is required to display "Scaffolding tag" including the project name, construction unit, inspection date to ensure workers can notice whether the scaffold is safety to use or not.
    1. Unloading platform, tower cranes, passenger hoist and any other equipment which required load limit requirements must display "Save Working Load."
  - v. High risk area of the construction site should be set up safety warning signs, and the contents should be easy to understand and meet the warning requirements.
  - vi. All Safety signage and Safety information board must written in **national language** or "**Bahasa Malaysia**" and follow by other language that can be understand by workers who work at the construction site.



*Signage figure*

## 22.5 Procedures

### 22.5.1 Safety Colors and Contrasting Colors

- a) **General meaning assigned to safety colours.** The safety colours which shall be used and the meanings which shall be assigned to them are given in **table 1** together with examples of the use of these safety colours and the contrasting colours which shall be used, if required.
- b) **Danger identification.** If identification is required of places where there is a risk of collision, falling, stumbling, falling objects or where there are steps, holes in floors or similar hazards, the following combination of fluorescent orange-red or safety colour yellow and in either case black shall be used. The proportion of fluorescent orange-red or yellow shall be at least 50%.



Table 1. Safety colours and Contrasting colours				
Safety Colour	Meaning purpose	Example of use	Contrasting colour (if required)	Symbol Colour
Red**	Stop prohibition	Stop signs Identification and color of emergency Shutdown devices Prohibition signs	White	Black
Yellow	Caution, risk of danger	Identification of Hazards (fire, explosion, radiation, chemical, etc.) Warning signs Identification of thresholds, dangerous passages, obstacles (see also 22.5.1(ii))	Black	Black
Blue	Mandatory	Obligation to wear personal safety equipment Mandatory signs	White	White
Green	Safe condition	Identification of safety showers, first-aid posts and rescue points Emergency exit signs	White	White

- c) This danger identification is used to identify the perimeter of the hazard. It may be used with or without a safety sign but where a safety sign is appropriate to identify particular hazard. Or where the situation is covered by a sign set out in appendix A, the danger identification marking shall not be used as a substitute for the safety sign.

## 22.5.2 General

### 22.5.2.1 Layout

- a) **Prohibition signs.** Background colour shall be white. Circular band and cross bar shall be red.

The symbol shall be black and placed centrally on the background and shall not obliterate the cross bar.

Red shall cover at least 35% of the area of the safety sign.

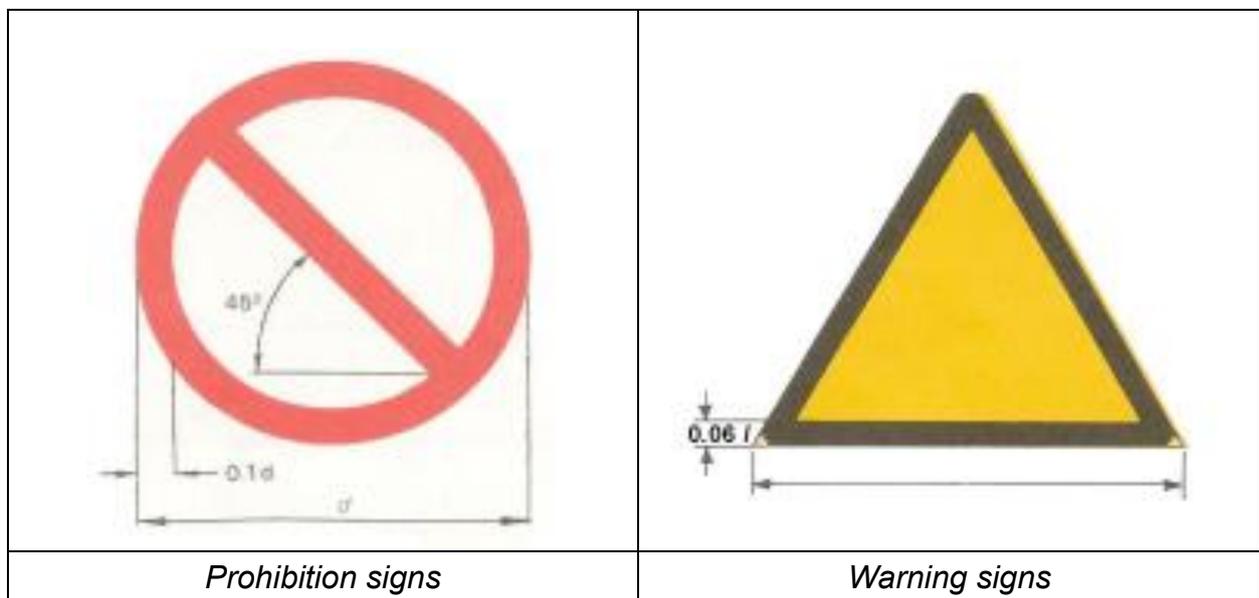
NOTE. Any text is to be put on a supplementary sign.

- b) **Warning signs.** Background colour shall be yellow.

Triangular band shall be black.

The symbol or text shall be black and placed centrally on the background.

Yellow shall cover at least 50% of the area of the safety sign.



c) **Mandatory signs.** Background colour shall be blue.

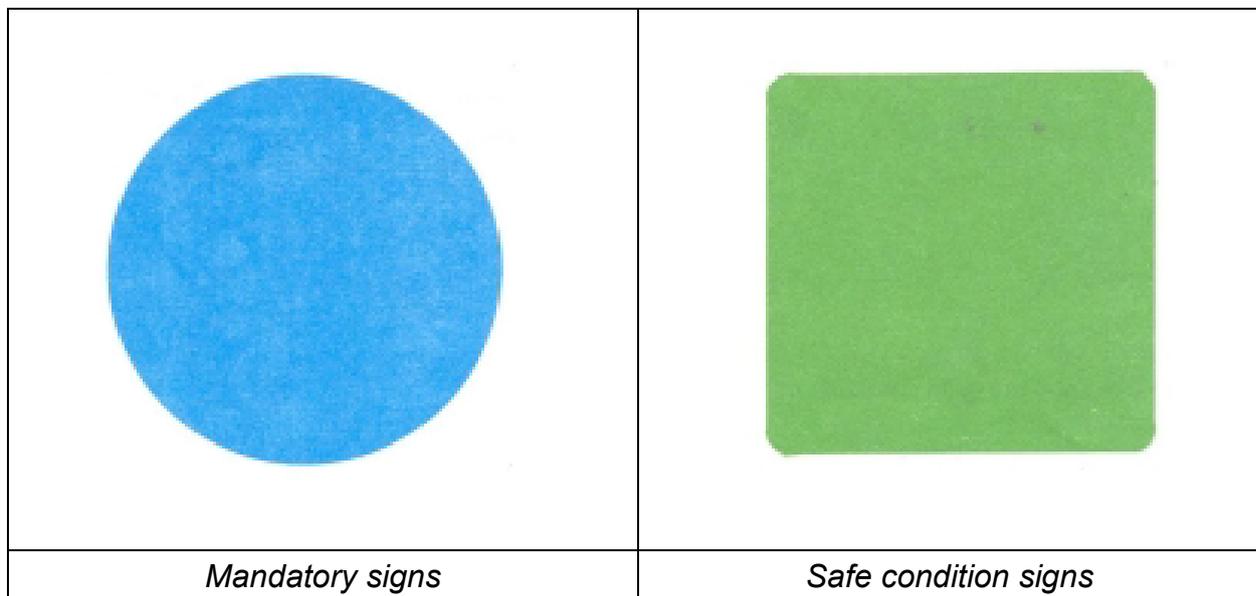
The symbol or text shall be white and placed centrally on the background. Blue shall cover at least 50% of the area of the safety sign.

NOTE. The symbols used on the mandatory signs shown in appendix A of this draft standard depict general types of protection. Where necessary, a specific type or level of protection should be indicated, in text, on a supplementary sign used in conjunction with the appropriate mandatory sign.

d) **Safe condition signs.** Background colour shall be green.

The symbol or text shall be white. The shape of the sign shall be oblong or square as necessary to accommodate the symbol or text.

Green shall cover at least 50% of the area of the safety sign.



#### 22.5.2.2 Design of Symbols.

- a) The design of symbols shall be as simple as possible and details not essential for the understanding of the message shall be omitted
- b) NOTE. If the symbols shown in this standard do not cover particular meaning. It is recommended that symbols which have already been standardized in other connections, or text only, should be used.

### 22.5.3 Supplementary Signs

- a) Supplementary signs shall be oblong or square.
- b) The background colour shall be white with the text in black. Alternatively, the background colour shall be the same as the safety colour used on the safety sign it is supplementing, with the text in the relevant contrasting colour.

### 22.5.4 Numbering and Marking of Floors

- a) Each floor of every building under construction shall be appropriately numbered or marked at the landing at every floor of every staircase or others access.



Building & floor numbering

## Appendix A

### Examples of Safety Sign and Their Meanings

Safety Sign		Meaning
A1.	PROHIBITION SIGNS	
A1.1		No Smoking
A1.2		Smoking and naked flames prohibited
A1.3		Pedestrians prohibition

A1.4		Do not extinguish with water
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Safety Sign		Meaning
A1.5		No Waste Water
A2.	WARNING SIGNS	
A2.1		Caution, risk of fire
A2.2		Caution, risk of explosion

A2.3		Caution, Toxic hazard
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	Safety Sign	Meaning
A2.4		Caution, corrosive substance
A2.5		Caution, risk of ionizing radiation
A2.6		Caution, overhead load

A2.7		Caution, industrial trucks
------	---	----------------------------

	Safety Sign	Meaning
A2.8		Caution, risk of electric shock
A2.9		General warning, caution, risk of danger
A2.10		Caution, Laser beam

A3	MANDATORY SIGNS	
A3.1		Eye protection must be worn

	Safety Sign	Meaning
A3.2		Head Protection must be worn
A3.3		Hearing protection must be worn

A3.4		Respiratory protection must be worn
A3.5		Foot protection must be worn
Safety Sign		Meaning
A3.6		Hand protection must be worn
A4.	SAFE CONDITION SIGNS	
A4.1		First Aid

A4.2		<p>Indication of direction (may be used in conjunction with A4.1)</p>
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# **CHAPTER 23**

# **FACILITIES**

## Chapter 23 Facilities

### 23.1 Introduction

Construction sites shall be provided with general facilities and utilities provisional in order to compliment basic necessity for administrative staff and workers in construction site so that the project progress and its execution carried out in an organized and convenient manner.

### 23.2 Objective

To ensure the facilities installation are in accordance to comply and fulfill to conform the stipulated regulation and to adopt standardized facilities arrangements for construction site.

### 23.3 Definition

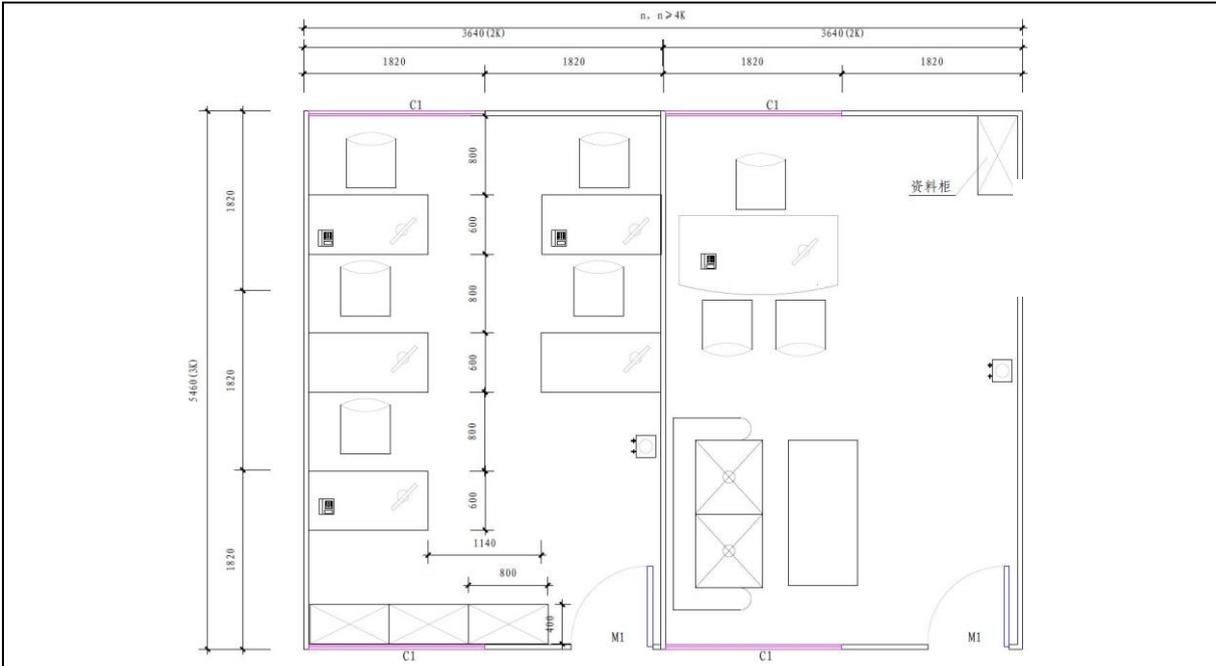
- a) **Site office** – Temporary administrative facility where business relating to specific property is conducted.
- b) **Living quarters** – Temporary building set up for the workers to lives until the project finish.
- c) **Drainage** – The system of water or waste liquids flowing away from somewhere into the ground or down pipes.
- d) **Site access road** – Road that enable traffic to reach a construction site or area
- e) **Flag pole** – A pole on which to raise a flag.
- f) **PPE self-check mirror** – Mirror for which workers to ensure that they wearing the needed PPE before entering the site.
- g) **Concrete test** – Test for concrete strength.
- h) **CCTV** – Surveillance system that install for security matter.

### 23.4 Legal requirements

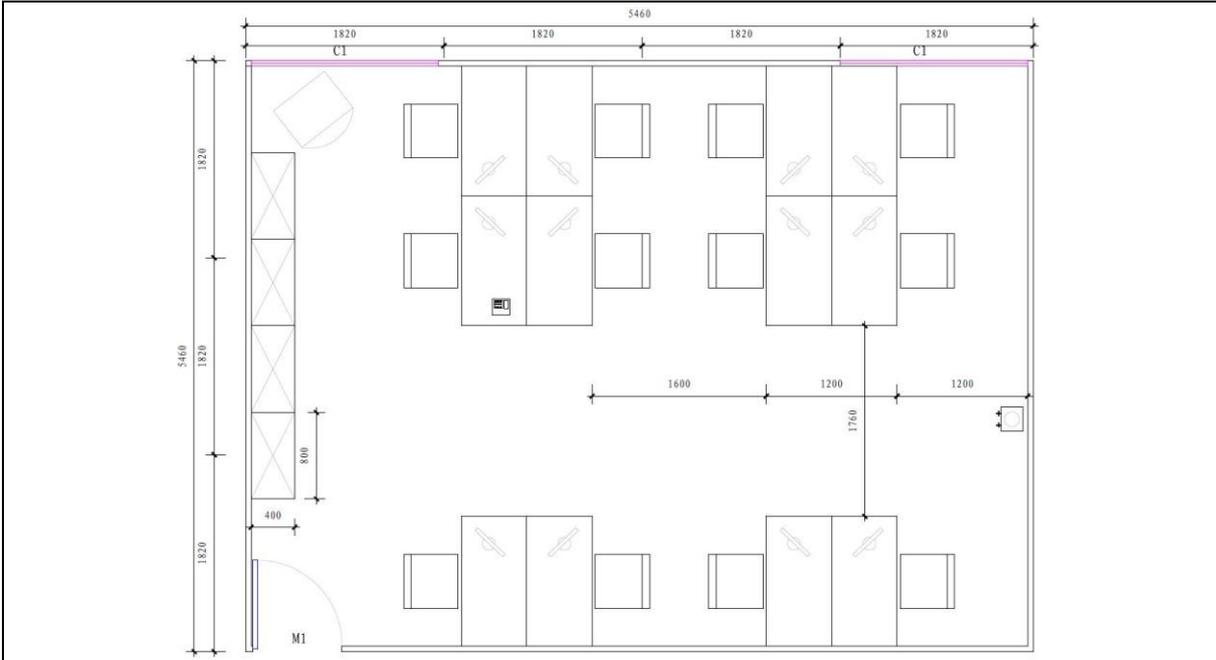
- a) Factory & Machinery Act 139 Safety, Health & Welfare
  - i. Regulation 24 – Use of safety helmet
  - ii. Regulation 29 – Inspection and Supervision of concrete work
  - iii. Regulation 30 – Beam, Floor and Roof
  - iv. Regulation 31- Stripping
  - v. Regulation 33(3) – Placing of structural members
  - vi. Regulation 37 – Permanent flooring
  - vii. Regulation 38 – Temporary flooring

## **23.5 Office**

- a) The office shall be set up inclusively with (offices, conference/meeting room), parking lot, first aid room, rubbish garbage with designated collection points and together with security guards post. The office area should be arranged centrally according to the terrain conditions. The office area should be set up separately from the construction area and shall not under the tower crane radius zone that simply corresponds isolation measures, and posted with relevant signboards to guide the public and construction workers of the office area.
- b) Generally the office layout can be arranged in according to "one", "L", "concave" shape type of which divided into two layers or storeys.
- c) The specific size of the office shall take into account the actual number of peoples to accommodate the office.
- d) Concave layout caters the corner areas with larger room generally suits for engineering, procurement office, project supervision department office of so on.
- e) The project manager office should be set up in a single office, in principle; it shall be at least 20 square meters.
- f) Each office units at least 20 square meters for sub-contractors office, number of units depends actual sub-contractors engaged for the project.
- g) Project safety department office shall be set up in a single office at least 20 square meters.
- h) Meeting room shall be set up in a single unit at least 50 square meters. The meeting also utilise for training board room especially for induction course for new workers.
- i) First aid room shall be set up in a single unit at least 10 square meters.
- j) Administrative office shall be set up at least 20 square meters.
- k) .Toilet to be set up as requirement of FMA 1967 on ratio of every 1:25 workers. The toilets shall adopt self-punching toilets, with good ventilation and lighting facilities. Set up a wash basin and a faucet.
- l) The office constructs by moveable steel frame panels fixture boards and brick stone for toilet areas.
- m) The ground floor surface shall be concrete with cement screeding finish flooring
- n) The ceiling is to be PVC types, the interior height should not be less than 2.5 meters of height.



Project manager and normal office plan (Recommendation)



Corner location office with larger floor plan layout (Recommendation)



### **23.6 Standard Office Accessory**

Apart of working desk, chairs and file cabinets, additional accessory shall be provided accordingly.

- a) Adequate air conditioning units shall be installing for all the office units.
- b) Office accessories such as; photocopy machines, fax machines and other office accessories shall be provided adequately.
- c) Engineering office unit shall be provided with discussion table, drawing racks and other professional accessories.
- d) Project manager office shall be provided with sofa chair and mini tea table for discussions.
- e) Meeting room shall equip with projector, multimedia equipment and television or screen panel.
- f) First aid room shall be equipped with full first-aid kit, medical oxygen, stretchers, single bed and other associated emergency equipment.
- g) All office units window are install with stainless grill and curtain.
- h) Drinking water fountains shall be provided adequately at strategic location.
- i) Adequate portable fire extinguisher shall be provided to the office area within vicinity of each office units.

### **23.7 Living Quarters**

- a) Living quarters should consider to isolate from the construction operation zone shall correspond isolation measures. The temporary housing shall maintain the safety distance from overhead electric power lines.
- b) The surrounding environment must consider safety condition such as soil collapses, low lying water areas and avoid excavation ground areas.
- c) Shall not set up in the radius of tower cranes.
- d) The centralise garbage point shall be 15 meters away from the living quarters.
- e) It is ideal to link with existing traffic lines to facilitate the workers to go and back from work.
- f) Provided with roads, smooth supply of water and electricity.
- g) The living area must have drainage system that allows water flows freely without stagnant.
- h) Each living unit shall have window for natural ventilation.
- i) Cooking is prohibited in the living quarters; the cooking facility buildings are to be detached from main living units at least 15 meters away.
- j) The living area should have emergency lane for BOMBA access, the width at least 4 meters and height clearance should not be less than 4 meters.
- k) Storage of flammable materials shall be 15 meters away from living quarters.
- l) Corresponding group of temporary living quarter buildings shall not exceed more than 10 unit and the distance between each buildings not less than 4 meters and the distance between groups of building not less than 8 meters

- m) The living quarters shall not exceed two floors.
- n) Portable fire extinguishers shall be provided adequately. The ground floor surface shall be concrete with cement screeding finish flooring and 1<sup>st</sup> floor surface with plywood 20mm thickness covering and on top of it with PVC carpets laying.

### **23.8 Centralized Toilets for Living Quarters**

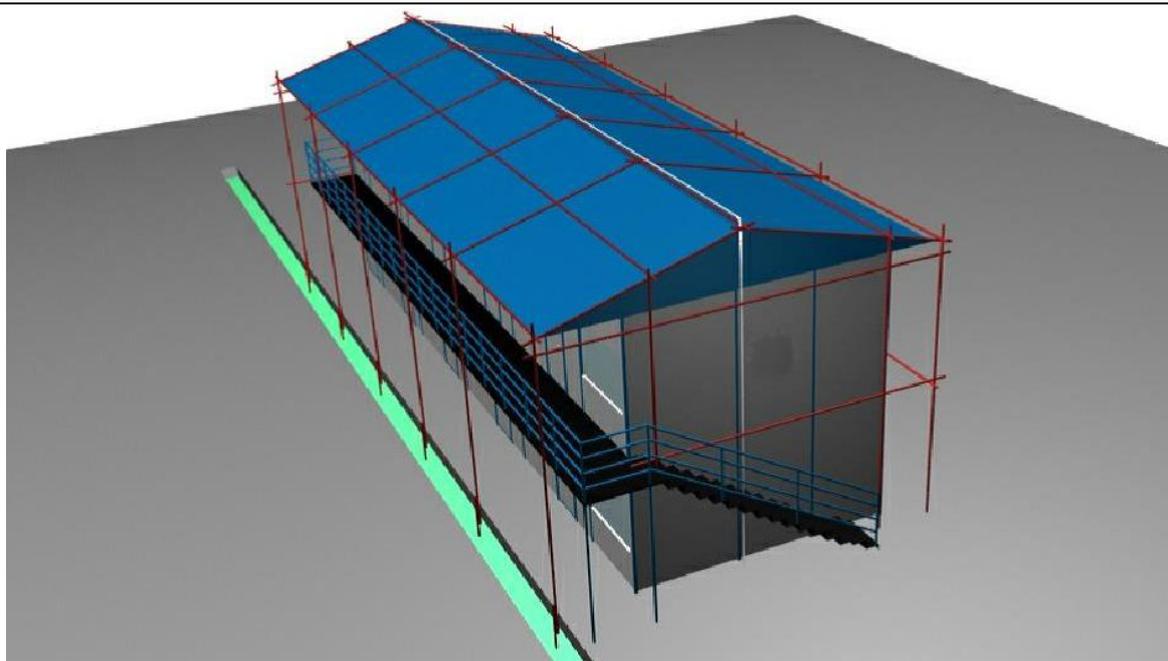
- a) Toilets and bathrooms in the living areas should be divided into 2 types which are male and female.
- b) Number of cubicles shall correspond to adapt number of people in the living area.
  - i. Sanitary unit with i) water closet ii) bath unit for every ratio of 1:15 workers.
  - ii. Sanitary unit with i) isolated bath unit ii) with urinal for every ratio of 1:25 workers.

(Refer to *Garis Panduan Penetapan Standard Minimum Penginapan Pekerja Asing, 2018*)

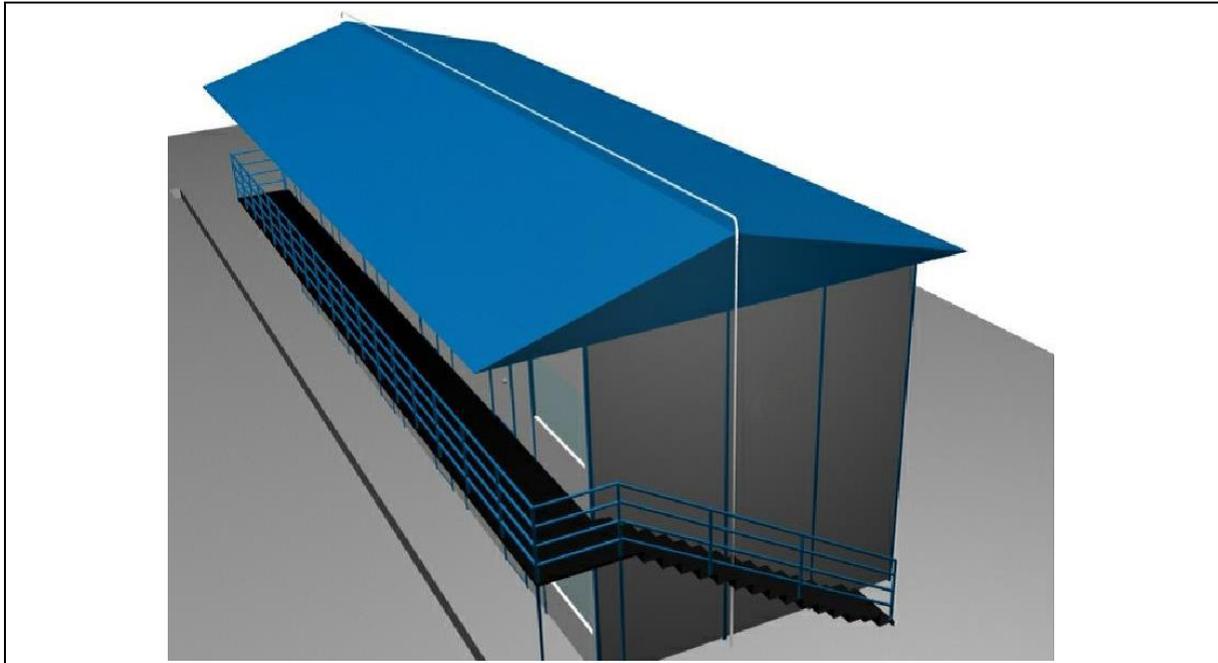
- c) Toilet building shall separate from living units at least 10 meters apart.
- d) Septic tank capacity determines according to the number of people anticipated to live as per the living quarter's size.
- e) The height of window is 1.8 meters for the bathrooms.
- f) Set up adequate urinals and water faucets for washing.



Aerial view of standardized setting up of office, living quarters & other facilities  
(Recommendation)



3-D rendering – Standard living quarter unit  
Reinforcement shall install to withstand strong by 48mm diameter steel pipe on the roof and short pipe surrounding the drainage. The short pipe shall embedded into the ground not less than 500mm and 300mm exposed above ground level and 2 fasteners to reinforced with the steel pipe. (Recommendation)



Cooling pipe layout  
Sprinkling water pipe over the roof for cooling action (Recommendation)



Stainless steel window grill  
(Recommendation)



Stainless steel window grill  
(Recommendation)



### 23.9 First Aid Room

- a) First aid station shall be on scale of project the basis, total number of workforce.

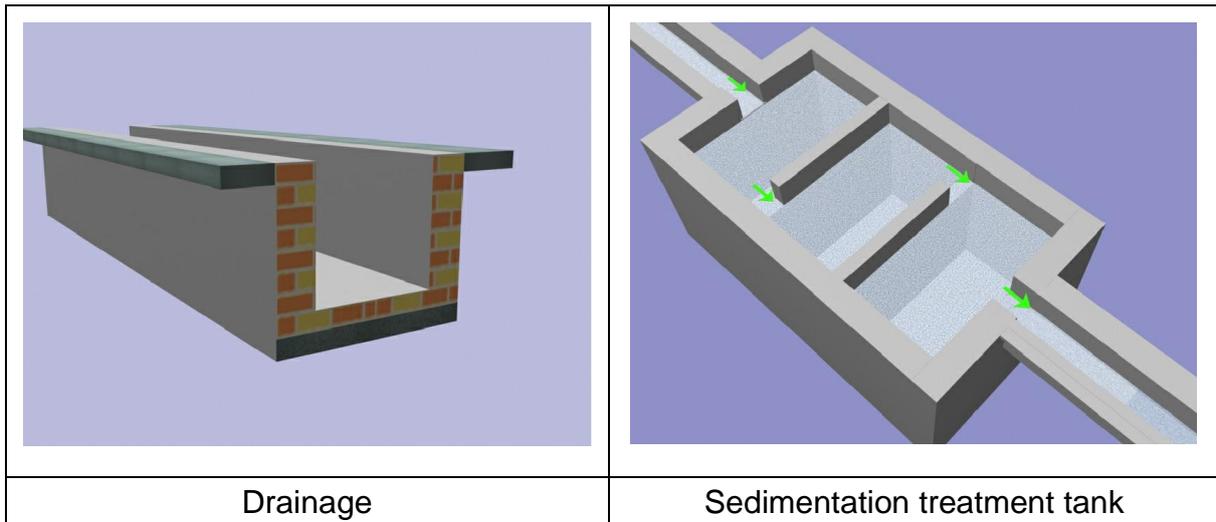


- b) To provide first aid facilities such as first aid kit box and stretcher. (Please refer to Regulation 38 (2)(i) Welfare, FMA 1967, Fourth Schedule)
- c) Single bedding for temporary recuperation for casualty upon waiting for ambulance arrival.

### 23.10 Drainage facilities

The construction site should have a good drainage system to ensure smooth water flow drainage system, no water should stagnant on the ground.

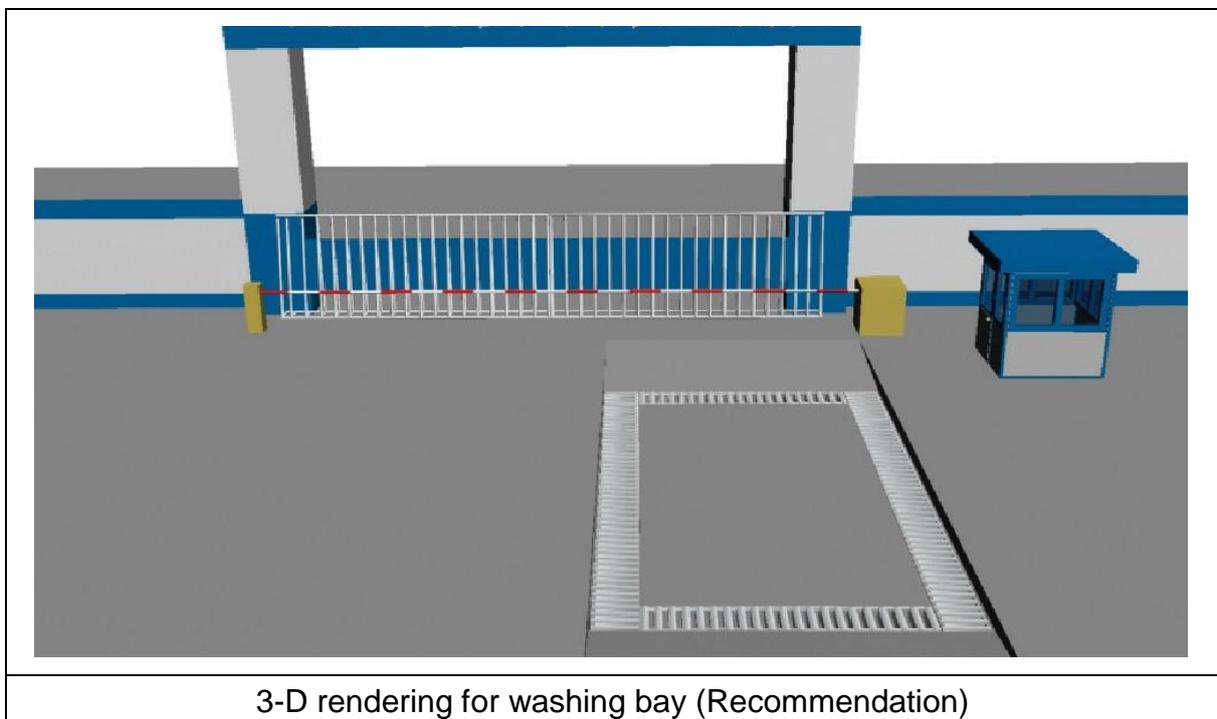
- a) It is forbidden to discharge waste oil, poisonous and harmful substances directly into the drainage system.
- b) Drainage shall construct with brick and surface to mortar plastered or install with pre-fabricated culvert.
- c) Drainage shall not less than 0.3 meters in width and the depth not less than 0.2 meters with have a certain gradient slope.
- d) Construction site should be set up a reasonable sedimentation treatment tank, sedimentation without treatment shall not directly discharge into the municipal drainage network.
- e) Sedimentation treatment tank shall construct using lime sand brick, mortar masonry, 20mm cement mortar plaster, to ensure that no leakage.
- f) Sediments in sedimentation treatment tank over the capacity of 1/3 should be clean regularly.



### 23.11 Vehicle Washing Bay

Construction site must be set up vehicle wash tank with high pressure flushing device.

- a) The wash bay shall be divided into two different section according dissimilar situations. One for vehicle wash for vehicles in and out of office and living area and the other vehicle wash for vehicle that goes into the construction area.
- b) The wash bay shall position at the exit of the gate.
- c) The construction of wash bay shall use steel channel and I-beam to form the grid to ensure sufficient strength to withstand vehicle loads. (Recommendation)
- d) Specific dimensions varies however should adopt standard vehicle size.

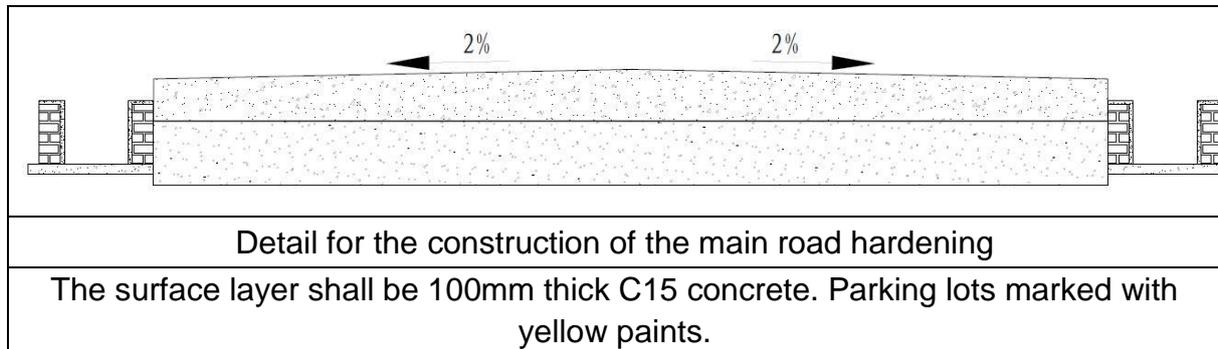


### 23.12 Road and Vehicle Parking (Recommendation)

The construction site road should be hardened; parts of temporary roads should lead to different directions to achieve certain location practically and economically.

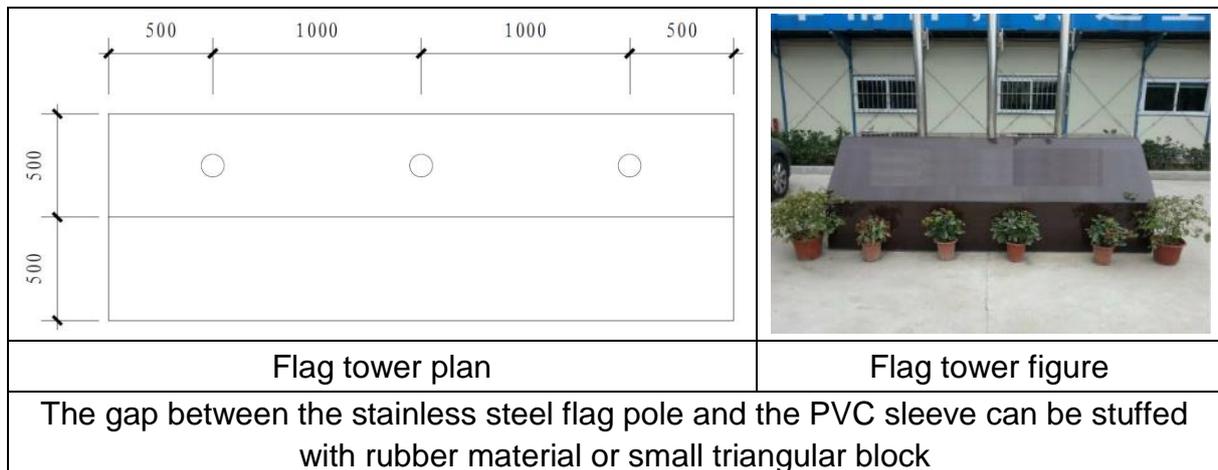
- a) If the temporary construction road is to be combined with permanent road planning, the road subgrade shall be constructed on permanent road design basis.
- b) Basic materials such as gravel and stone should design based on soil condition.
- c) A single side drainage to set up along the road side.

- d) The parking lot shall have better compaction on soil ground and pour sand to arrange the inter-lock brick, other hardening methods depends on site soil conditions.



### 23.13 Flag Tower (Recommendation)

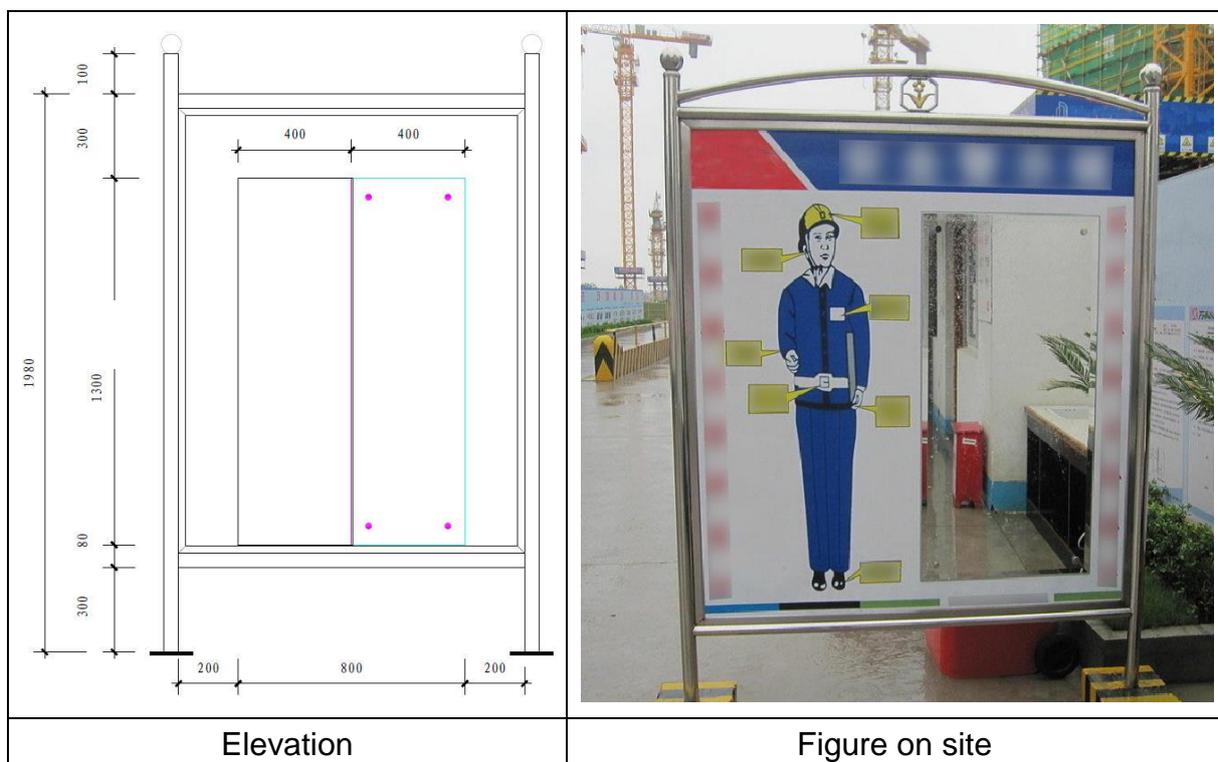
- The flag tower shall set in prominent position especially in front of the project office or at the main entrance.
- The flag pole shall be embedded into concrete base not less than 1 meter depth.
- The flag poles height variant if in combination of 3 flag poles set shall be ; the middle pole height is 11 meters and other 2 poles on both sides height will be 10.8 meters.
- The flag pole material shall be stainless steel tube thickness  $\geq 2\text{mm}$  with 102 diameter up to 5 meters length bottom and central pole zone for length 4 meters the diameter reduce to 96mm, the upper portion of pole shall be 90mm diameter for length 2 and 1.8m respectively.



### 23.14 Safety Mirror (Recommendation)

Safety mirror should be treated as a self-check tool for reminding personal protective equipment correctly donned prior to entry into site.

- a) The mirror shall install at the entrance of the site and the mirror should cover full body height.
- b) The mirror glass is made of stainless steel frame body and fixed on the ground rigidly with 4 times expansion bolts.



### 23.15 Rest Area cum Smoking Zone

Rest area be utilize as smoking zone at construction for workers. Specific number rest area shall be depend on the size of the project. Normally one area will be designated for each site without corresponding the size of project.

- a) Shall be provided with rubbish bin and fire extinguisher.
- b) Posted with appropriate signboards indicating rest area and smoking zone.



3-D rendering Smoking kiosk and tea kiosk (Recommendation)

### 23.16 Surveillance System

In order to enhance the construction site security supervision and to improve safety management level a video monitoring system should be set up on the construction site.

- a) Video surveillance system can play the role as monitoring site security and fire safety.
- b) Should designed on site personnel management to develop electronic inspection system.
- c) Number point shall be determine by project size and requirement.



Live video surveillance system

### 23.17 Hazard Identify Board to Setting up temporary site office & living quarters.

- a) Personal falling from height.
- b) Electrocution whilst handling electrical tools.
- c) Struck by falling objects.
- d) Caught in between object.
- e) (Refer to Appendix 1)

**23.19 Control Measure – (Preventions measures - Safe work practice)**

- a) Working at height more than 3 meters to erect scaffold for safe foot hold platform and workers to wear safety harness and hook to nearby rigid points.
- b) Electrical tools shall be inspected prior to usage, industrial socket to be adopted.
- c) Loose tools to be secured properly to prevent drop off accidentally from height and steel frames to be stack properly to prevent from toppling.
- d) Keep bodily parts away from moving objects towards stationary objects and use tagline to control load upon hoist or lowering by crane.

## APPENDIXES

### Appendix 1 – Risk assessment

S/No	Hazard	Possible injuries	Existing control measures	Additional control measures	Legal references
1	Fall from height	Serious injury	<p>All workers are to use proper and secure working platforms (scaffolding) when installing the metal structure, roofing, lightning conductor, false ceiling, water proofing or railing</p> <p>All workers are to wear safety harness and anchor the lanyard when working near edges of building or on the roof</p>	Obtain an approved working at height permit prior to commencement of work	<p>FMA SHW Reg.7,12</p> <p>FMA BOWEC Reg.53, 67, 86</p>
2	Electric tools or appliances	Electrocution	Electrical tools such as drill, cutter, grinder, welding machine, etc. to be inspect before using on site	Industrial sockets and tools shall be use and to be check by safety department prior to usage at site.	FMA BOWEC Reg.147

3	Struck by falling objects	Cuts, bruise or fracture	<p>Loose tools are to be secured or placed properly to prevent them from accidentally falling off the working platforms</p> <p>Steel frame to be stacked properly to prevent them from toppling</p> <p>Protruding sharp edges to be protected from accidental contact</p>	Additional PPE to be donned such as suitable appropriate hand gloves	<p>FMA SHW Reg.19,20</p> <p>FMA BOWEC Reg.9(2)</p>
4	Caught in between objects	Crash, contusion or fracture	To hoist or stack material properly and keep bodily parts away from moving load towards stationary object	Use tagline or guide rope to control the load upon lowering and during hoisting.	FMA BOWEC Reg.35

# **CHAPTER 24**

**MACHINERY**

**AND**

**EQUIPMENT**

## Chapter 24 Machinery and Equipment

### 24.1 Introduction

Machineries, equipment and portable hand tools are widely being used in construction site, misuse could contribute to accidents, extra care is to be exercise while operating to prevent accidents and statutory machineries such as tower cranes, passenger hoist, gondola and compressors requires authority approvals for installation, operation and dismantling, hence special scheme of procedures to be outlines to liaise with authority.

### 24.2 Objective

This procedure is develop to guide the employer to disseminate instruction to their workers the proper and safe operation to prevent accidents due to misappropriate or abusive usage whilst operating machinery or equipment.

### 24.3 Scope

This procedures applies to construction works that are involves the use of mechanical power driven machinery or equipment.

### 24.4 Definition

- a) **Power tools** – A tools that is actuated by an additional power source and mechanism other than the sorely manual labour used with hand tools.
- b) **Compressor** – A machine or part of machine that squeezes gas or air and make it take up less space
- c) **Concrete mixer** – A device that homogeneously combine cement, aggregates such as sand or gravel to form concrete.
- d) **Cranes** – A large machine or tall metal structure with long horizontal part that used for lifting and moving heavy object.
- e) **Generators** – A machine that converts one form of energy into others, especially mechanical energy into electrical energy.
- f) **Competent person** – Person who authorized by DOSH to operate certain machinery or doing certain machinery inspection.
- g) **Competent Firm** – A company that has obtained the written approval from the Director General of DOSH.
- h) **Guarding** – To keep safe from harm or danger; protect
- i) **Checklist** – A list of thing to be checked or done.
- j) **Anti-collision device** – A device or sensors that help to prevent collision between two tower cranes.

## **24.5 Legal Requirements**

- a) OSHA 514 Section 15
- b) FMA 139
  - i. Section 19 – Certificate of fitness
  - ii. Section 36 – Installation of machinery
  - iii. Section 37 – Application of registration
- c) BOWEC Regulation
  - i. Regulation 147 – General requirement
  - ii. Regulation 148 – Hand tools
  - iii. Regulation 149 – Electric power- operated tools

## **24.6 Power Tools**

### **24.6.1 General Instructions for Power Tools. (Refer to Chapter 16 Mechanical & Electrical)**

- a) Electrical equipment's to be industrial type socket.
- b) The guarding on the rotating parts of the machinery and equipment to be intact.
- c) Do not operate any machine or equipment if it is not in good working condition.
- d) No person shall be permitted to operate statutory machineries unless they hold competency certificates.

### **24.6.2 Inspection of Power Tools.**

An extensive use of electrical power tools without adequate care, maintenance and correct use may become hazardous and endangering to life, hence it is crucial to ensure the followings.

- a) Electrical tools must be maintained in a serviceable condition at all times.
- b) Carried out regular safety test or formulate routine preventive maintenance program.
- c) Never allow electrical cables lay in water or on wet floor.
- d) Do not use electrical tools in wet conditions.
- e) Always assess the job at hand, then select the correct tool.
- f) Check for faults or defects on plugs, flexible cords and defective guards.
- g) Double adapters and three pin plug adapters or similar type fitting shall not be used.
- h) Electrical cables should be elevated above the floor surface or working platform.
  - a) Use only double insulated portable electric tools.
- i) Any worn or damaged equipment must be withdrawn from operation immediately.
- j) Ensure the ELCB is in functional condition.

### 24.6.3 Drill machine

- a) Chuck wrenches shall be removed from drill chucks before activating the machine.
- b) Never attempt to hold the work with your hands. Always clamp the work on the table.
- c) Use the drill only at a proper speed; forcing or feeding too fast may result in broken or splintered drill bits, which may cause serious injuries.

### 24.6.4 Power Driven Saw

- a) When turning on the power stand on the side of the machine.
- b) Mount the material of work only when the saw blade is completely stopped.
- c) When using the sliding stock guide do not allow your fingers to stick out beyond the end so they will not come in contact with the saw blade.
- d) Be sure that the blades for both circular and band saws are in good condition before use. A sign that the blade has a crack is a sharp regular clicking sound that can be heard as the work is being fed. Change the blade at once if this situation arises.
- e) If the saw blade breaks during the operation, shut off the power and do not attempt to disengage the blade from its position until the machine has come completely stopped.
- f) Bench saws shall be fitted with a riving knife, overhead guard, kicking plate and easily accessible emergency stop push-button.



Circular saw protection figure



Circular saw protection figure

#### **24.6.5 Grinder**

- a) The face of the wheel must be flat and free from any grooves.
- b) Do not apply too much pressure that might cause the wheel to strike back suddenly due to broken disc.
- c) Never use a grinding wheel that is loose on the shaft.
- d) Stop the wheel if it vibrates excessively as indication of unbalance wheel.
- e) Use clamps or other suitable holding devices for grinding small items.
- f) Always wear eye protection when using a grinder.

#### **24.6.6 Pumps and Air Compressor.**

Exposed rotating couplings on pumps shall be adequately guarded and when the guards are removed for oiling or repairing they shall be replaced before the pumps are put back in operation.

- a) Ensure that the compressor have valid PMT certificates of fitness issued by DOSH of Malaysia.
- b) Where an internal combustion engine is used to drive a compressor, ensure it is place outdoor to prevent monoxide accumulation inside the building.
- c) If repairs or adjustments are to be made to a compressor, ensure that the header valves are closed and that no air pressure remains in the cylinder. Ensure that all relief valves are open. Apply lock out and tag out procedure.
- d) Place oil drip containment tray of sufficient size to contain if any oil drips during operation.
- e) All high pressure hose connections to have a secondary snap guard to prevent inadvertent swinging of hose while connection dislodge accidentally.
- f) Release the condensation on weekly basis.



### 24.6.7 Concrete Mixer

- a) The rotating parts must be guarded adequately and rendered harmless for the persons working nearby the machine.
- b) Fuel fired mixer to provide oil containment tray and to be station outdoor.



## 24.7 Heavy Machinery

### 24.7.1 Mobile and Crawler Crane

- a) Must be operated by competent person who hold a valid competence certificate issued by DOSH Malaysia.
- b) Must have a valid PMA certificate of fitness issued by DOSH Malaysia.
- c) Must have trained rigger and signalman to sling, rig and direct the load.
- d) Establish secure communication with the operator.

- e) If the load is not within the eyesight of the crane operator, use proper communication tools as form of communication and to be establish prior to commence of lifting operation.
- f) Apply and obtain an approved hoisting permit to work system
- g) Carryout pre-operation inspection checklist prior to commence lifting operation.(refer **Appendix for inspection checklist**)
- h) Ensure load indicator function properly and ensure safe working load corresponding to the radius.
- i) Ensure overloading warning device functioning and hoisting block limit switch installed.
- j) Ensure outriggers to be based on steel plate measuring 1x1 meter radius and fully extended out.
- k) When travelling with hydraulic cranes, the telescopic boom must be in the retracted fully.
- l) Fitted with functional safety latches and marked the safe working load.
- m) Never lift the load over the head of any person.
- n) The load uplifted one meter from the ground to check the load centre of gravity and well balanced.
- o) Use guide rope or tagline to control load, the guide rope must be at least three meter of length.

#### **24.7.2 Sky-lift**

- a) Must have a valid PMA certificates of fitness issued by DOSH Malaysia.
- b) Carryout pre-operation inspection checklist prior to operate the sky-lift.
- c) Ensure overloading and boom limit buzzer is functional.
- d) Only 2 people allowed being in the cage and wearing safety harness and hooking the lanyard to cage.
- e) Outrigger to be extended fully and to be based on steel plate.
- f) Always check any overhead hazards such as; power lines, building structures and other objects.

#### **24.7.3 Scissor lift**

- a) Must have a valid PMA certificates of fitness issued by DOSH Malaysia.
- b) Carryout pre-operation inspection checklist prior to operate the scissor lift.
- c) Only trained personnel to operate scissor lift.
- d) Operators shall wear safety harness and hook the lanyard scissor lift cage rail.
- e) Shall not exceed safe working load.
- f) Operate on a level and hard surface.

#### **24.7.4 Tower crane**

**a) Authority approval**

- i. Obtain material and design approval from DOSH Putrajaya office prior to new tower crane to be mobilize to site.
- ii. Obtain installation or dismantling “SURAT KEBENARAN” approval letter from DOSH State office.
- iii. Tower crane installation and dismantle must be supervise by competent person for tower crane whom holds valid competency certificates issued by DOSH Malaysia.
- iv. The foundation base of tower crane shall inspect and approved by DOSH Officer prior to cast concrete.
  
- v. DOSH Officer and competent person will carry out load testing after installation to ascertain the fitness of crane for operation, upon surpassing the load test DOSH Officer may permit the tower crane for operation by signing the conditional approval in load test inspection checklist during the processing period to issue PMA certificate.
- vi. Tie-back of tower crane shall be in accordance of professional engineer’s design drawing.
- vii. The competent person for tower crane shall notify to DOSH office for the process of jacking up the tower crane.

**b) Operation**

- i. Tower crane shall be operated by competent person whom holds valid competency certificate issued by DOSH Malaysia.
- ii. To formulate a written lifting plan. All lifting operation shall incorporate in accordance of establish lifting plan.
- iii. Lifting operation shall be supervise by trained lifting supervisor.
- iv. Load rigging works shall be carryout by trained rigger.
- v. Lifting operation shall be coordinate by the signal man to the crane operator.  
**(refer to Appendix for appointed letter for signal man)**
- vi. Shall establish standard communication between signal man and the operator with clear and uninterrupted link.
- vii. Tower crane operator shall carry out daily the pre-operation safety inspection checklist, if found any discretion which affect the safe operation shall cease crane operation.**(refer to Appendix for inspection checklist)**
- viii. To ensure safe operation, **Project Site Intelligent System** is implemented.
- ix. All operator suppliers must comply with the Malaysian Labour Law which the company must provide the operator with KWSP and SOCSO.

- x. Supplier must obey with the contract provided by the employer and any incompliance from the supplier, the contract will be terminated immediately.
- xi. Operator must sign Compliance Agreement with the employer. **(refer to appendix for letter of compliance agreement)**

#### 24.7.4.1 Project Site Intelligent System

This system is implemented to ensure safe operation of the tower crane. As to ensure compliance of the licence operators from hiring illegal operator (*without license/foreign worker*). The intelligent system also are made to ensure all the information and decision making by management are given on-time.

#### 1) System Category

分类 Category	应用点 Used on	使用人员 Usage by
作业面管理 Operate/Task Management	微信端应用 WeChat App	项目管理团队、施工单位、监理单位 Site Managing Team, Construction Unit, Supervisory Unit
协同审批 Collaborative approval	微信端应用 WeChat App	项目管理团队、施工单位、监理单位 Site Managing Team, Construction Unit, Supervisory Unit
传感监测 Sensor Monitoring	管理人员定位 Personnel Positioning	项目管理团队 Site Managing Team
	现场天气监测 Weather Monitoring	项目管理团队 Site Managing Team
	塔吊安全监控 Tower Crane Monitoring	项目管理团队、施工单位、监理单位 Site Managing Team, Construction Unit, Supervisory Unit
	施工电梯监测 Elevator Monitoring	项目管理团队、施工单位、监理单位 Site Managing Team, Construction Unit, Supervisory Unit
	视频监控 Video Surveillance	项目管理团队 Site Managing Team
控制室管理 Control Room Management	大屏幕控制室 Huge Screen Control Room	项目管理团队 Site Managing Team

#### 2) Sensor Monitoring

传感监测 Sensor Monitoring	管理人员定位 Personnel Positioning	项目管理团队 Site Managing Team	手机APP Mobile App
	现场天气监测 Weather Monitoring	项目管理团队 Site Managing Team	实时气象监测 Real time Weather Station
	塔吊安全监控 Tower Crane Monitoring	项目管理团队、施工单位、监理单位 Site Managing Team, Construction Unit, Supervisory Unit	塔吊安全监测及分析 Tower Crane Monitoring and analysis
	施工电梯监测 Elevator Monitoring	项目管理团队、施工单位、监理单位 Site Managing Team, Construction Unit, Supervisory Unit	施工电梯运行监测及分析 Elevator Monitoring and Analysis
	视频监控 Video Surveillance	项目管理团队 Site Managing Team	主体施工作业面监控 Construction Building Operation Monitoring

### 3) Personnel Positioning

By using Electronic Tag and GPS tracking on the phone, management can monitor the location of the operators at all time.

### 4) Weather Monitoring

This weather monitor is located at Site Weather Station that able to detect rainfall, wind speed, wind direction, temperature, humidity, noise and haze. By using this monitoring system operator can avoid being in the cabin during strong wind or thunder storm that can endanger operation, operator life and others.

System will record everyday data and then process with analysis link to Task Management System.

### 5) Tower Crane Monitoring

Every tower will be installed with “*Tower Crane Anti-Collision System*” and sensor system to ensure safe operation or colliding of the tower crane.

The tower crane also will be provided with needed communication between signal man, control centre and between each tower crane that operated.

Due to safeguard of the operation, the system will record every operation and analysis. This will ensure early warning and cut-off system during the dangerous operation(emergency).

## **6) Elevator Monitoring**

During the operation, all elevated will be equipt with laser sensor that will record real-time activity and the system can further optimize the usage of elevator by efficiency through data analysis.

## **7) Video Surveillance System**

During construction of main structure, the camera will installed at building height point. The real-time picture of each working surface can be view via management system.

By combining data with analysis data, the "virtual and real combination" can be achieved, and this will enhance on-site management to get more precise information.

### **c) Maintenance**

- i. Carry out monthly schedule maintenance inspection and service, the service report shall be retain for record keeping at site office.
- ii. Shall install safe access platform on the tie-back beam for access and egress to tower crane. The safe walk way platform shall install with guardrail on both sides at 1.2m height for top rail and 600mm of height for mid rail.
- iii. At the base of tower crane shall install a board to display information pertaining to PMA certificates, operator competency certificate, the names of lifting supervisor, rigger and signalman.



Acceptance card figure

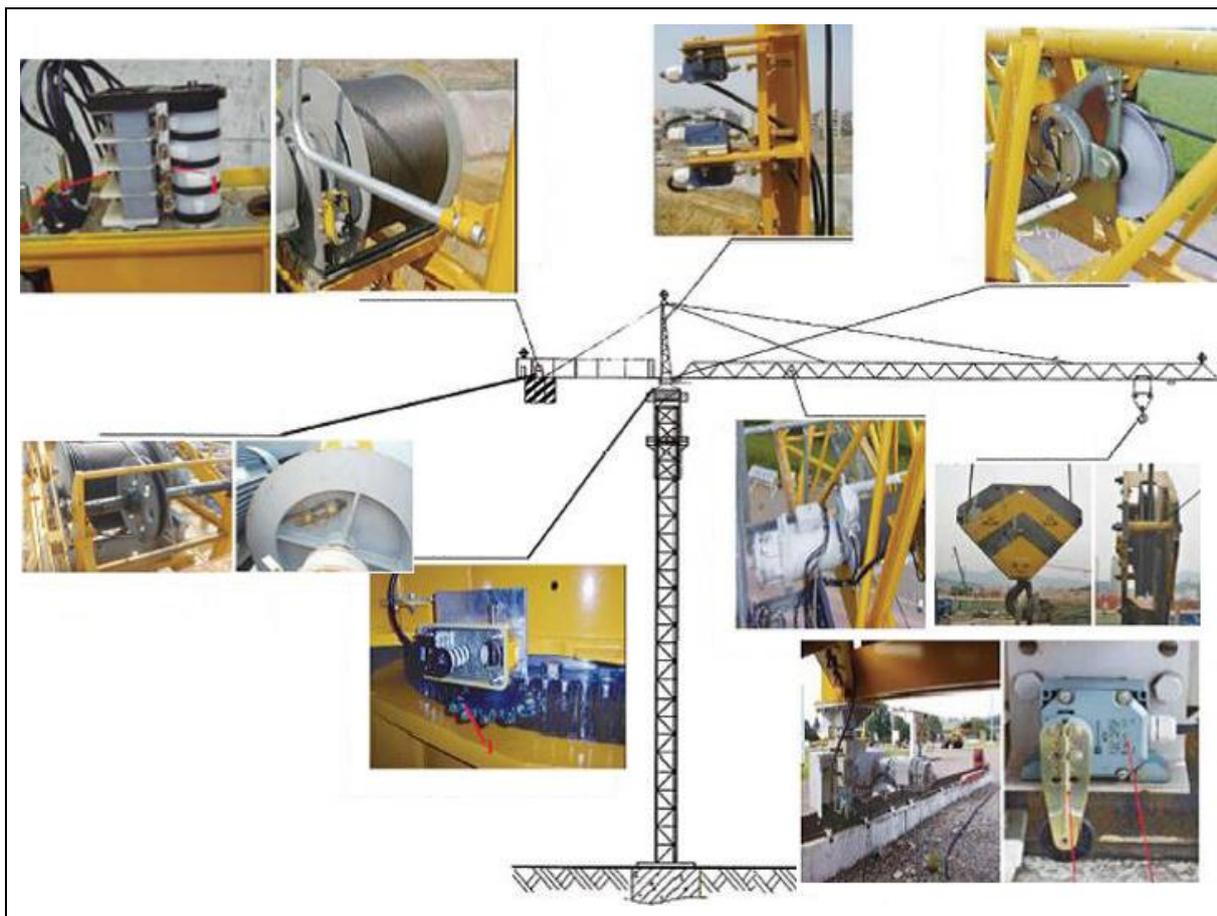
**d) Details of foundation**

- i. Lifting rate is less than 400kN (40T) the pit size is 6500mm x 6500mm value must be  $\leq 80\text{kpa}$  ( $8\text{T/m}^2$ ) and for lifting rate greater than 400kN (40T) the foundation bearing load must be  $\leq 100\text{kpa}$  ( $10\text{T/m}^2$ ).
- ii. Reinforcement steel bar shall be arranged in accordance of engineer's specification, concrete grade should be above Grade 35.
- iii. The foundation should be designed, constructed and installed according to the requirements for the use of the tower crane.
- iv. The foundation must be checked and approved according to PE endorsement by the competent person before installing.
- v. Free standing tower crane installation height must not more than 20 meters height.
- vi. When installation is more than 20 meters tie back must be installed according to PE design



**e) Safety devices**

- i. Rotation limit ; to set as per requirement,
- ii. Hoisting limit; minimum limit distance is 1000mm – 1500mm to boom body.
- iii. Anti-collision device ; to install as per requirement to prevent collision between tower cranes
- iv. Overload limit; to set in accordance of approved safe working load.



#### **24.7.5 Generator**

- a) Generators that exceed 100KVA shall notify and obtain approval from DOE.
- b) Generators shall be station externally outside the buildings.
- c) Provide oil containment tray of sufficient size to contain oil spillage.
- d) Portable fire extinguisher to provide nearby each generator.
- e) Flammable substances or material shall store 3m away from generator.

## APPENDIX 1 BENDING MACHINE SERVICE REPORT



Giant Leap Construction SDN. BHD.

### BENDING MACHINE SERVICE REPORT

Company		Rebar yard no.	
Month		Year	

S/ No	Week Date	1		1		3		4		Remarks
		Y	N	Y	N	Y	N	Y	N	
		Check Items								
1.	Emergency stop functioning?									
2.	Clampbar is free of caught in between hazards ?									
3.	Backstop bar and hinges lubricated?									
4.	Any leaking of oil from the cherry picker's.									
5.	Clampbar and beam edges are in good condition ?									
6.	Raised burrs surface in clean condition ?									
7.	Machine securely anchored to floor?									
8.	Secondary oil drip tray provided ?									
9.	Workers wear ear and hand protection ?									
10.	Foot pedal functioning properly ?									
Machine handler's Signature :										
Verified by Supervisor :										

Y - Yes

N - No

## APPENDIX 2 APPOINTED LETTER FOR SIGNAL MAN



**Giant Leap Construction SDN. BHD.**

2B, Lot 2001, Jalan Laman Setia 2/20, Taman Setia Eco Garden, 81550 Johor Bahru, Johor.  
Regional Office & Project Office : Tel : +60 7 5095867 Fax : +60 7 5095197

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Reference no : **Shc / GLC / FC /** \_\_\_\_\_

Date : \_\_\_\_\_  
Project : **FOREST CITY – Plot 4 (Tower Crane No. \_\_\_\_\_ )**  
Address : **TG. KUPANG, JOHOR.**

Attention to MR. \_\_\_\_\_

Dear Sir,

**SUBJECT : APPOINTMENT OF SIGNALMAN FOR LIFTING OPERATION**

This is to confirm that you, **MR.** \_\_\_\_\_ has been appointed as SIGNALMAN as per the requirement of JKPP seculars dated 5<sup>th</sup> June' 2017 for the CGPV Forest City Plot 4 Project site at Tanjung Kupang, Johor with immediate effect.

You are therefore obliged to :

- Give correct and clear signal to the crane operator by audible through walkie-talkie or hand signal.
- Wear red vest and blue safety helmet for identification.
- Ensure the load suspended route paths are clear of personnel below.
- Ensure the load lifted with correct center of gravity.
- Ensure the load has been rigged properly.
- Ensure your walkie-talkie in working condition all the times.

Thank you.

By order of,

\_\_\_\_\_  
GU ZHI HUI  
Project Manager

Acknowledgement :

.....  
Name : \_\_\_\_\_

## APPENDIX 3 LETTER OF COMPLIANCE AGREEMENT



**Giant Leap Construction SDN. BHD.**

2B, Lot 2001, Jalan Laman Setia 2/20, Taman Setia Eco Garden, 81550 Johor Bahru, Johor.

Regional Office & Project Office : Tel : +60 7 5095867 Fax : +60 7 5095197

### PENGAKUAN PEMATUHAN PERATURAN KESELAMATAN & KESIHATAN PEKERJAAN DI TAPAK

Nama : \_\_\_\_\_ No. KP : \_\_\_\_\_

Syarikat : **YUAN YI ENTERPRISE** Jawatan : **PENGENDALI KREN MENARA** Warganegara : \_\_\_\_\_

Tarikh Lahir : \_\_\_\_\_ No. Talipon : \_\_\_\_\_ Umur : \_\_\_\_\_

Tempoh bekerja dengan syarikat ini : \_\_\_\_\_ Pengalaman kerja di bidang ini : \_\_\_\_\_

\*\*Sejarah perubatan yang lalu atau alahan \_\_\_\_\_

No. Talipon hubungan kecemasan \_\_\_\_\_ Nama \_\_\_\_\_

Saya \_\_\_\_\_ bekerja di tapak pembinaan "FOREST CITY" untuk GIANT LEAP CONSTRUCTION SDN. BHD. dengan ini bawanya, saya mengakui dan bersetuju untuk mematuhi peraturan-peraturan Akta 514 Keselamatan, Kesihatan Perkerjaan dan Akta 139 Jentera dan Kilang Malaysia, yang telah ditaklimatkan kepada saya pada hari pertama mula bekerja di tapak ini. Kegagalan untuk mematuhi peraturan dan syarat yang dinyatakan diatas saya membenarkan pihak GIANT LEAP CONSTRUCTION SDN. BHD. untuk mengambil tindakan tatatertib terhadap saya. Senarai arahan tambahan yang perlu dipatuhi :

1. Sentiasa mengamalkan operasi pengangkatan yang selamat.
2. Mengelak beban tergantung ketika orang berada dibawah.
3. Tidak membenarkan orang lain untuk mengendalikan kren.
4. Tidak mengubahsuai peranti keselamatan yang telah dipasang pada kren.
5. Sentiasa memerhatikan beban yang diangkat dalam lingkungan "beban kerja selamat".
6. Mematuhi arahan-arahan keselamatan dan berkerjasama untuk pengangkatan yang selamat .
7. Berhenti operasi kren jika dikhuatiri tidak selamat atau ketika cuaca buruk dan dikesan ada halangan.
8. Beritahu kepada majikan secepat mungkin sekiranya tidak dapat datang untuk kerja.
9. Melakukan pemeriksaan senarai semak keselamatan kren sebelum beroperasi.
10. Beban yang diangkat dan tergantung tidak boleh melepasi jalanraya utama yang berada di luar pagar tapak bina.

Diakui oleh :

Nama		Tandatangan	
Syarikat	YUAN YI ENTERPRISE	Tarikh :	

Saksi oleh :

Nama		Tandatangan	
Nama		Tandatangan	

\*\* MAKLUMAT PERIHAL PERUBATAN DAN ALAHAN ADALAH PERKARA SULIT DAN PERSendirian DAN AKAN DIRAHSIAKAN DARIPADA UMUM.

## APPENDIX 4 CRANE INSPECTION CHECKLIST

 <p><b>腾越建筑</b> GIANT LEAP</p>	<h3>CRANE INSPECTION CHECKLIST</h3>
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( To be complete by crane operator )

Date of inspection : \_\_\_\_\_

Type of crane :            Tower / Mobile / Others \_\_\_\_\_

Item	Description	Condition ( Please / )			Remarks
		GOOD	FAIR	POOR	
1	Boom				
2	Brake				
3	Counter Weight				
4	Hoisting Motor				
5	Horn				
6	Hydraulic System				
7	Ladder				
8	Load Chart				
9	Operator License				
10	Outrigger				
11	PMA				
12	Pulley				
13	Reverse Alarm				
14	Reverse Light				
15	Roller Trolley				
16	Safety Hook				
17	Safety Pin / Lock Pin				
18	Shackle				
19	Spot Light				
20	Swing Motor				
21	Swing Table				
22	Trolley Motor				
23	Wire Rope				
24	Others				

Inspected By :  
Crane Operator / Name :  
\_\_\_\_\_

Verified By: \_\_\_\_\_  
Safety Personal / Name ;  
\_\_\_\_\_

# APPENDIX 5 DAILY TOWER CRANE INSPECTION DONE BY OPERATOR

HSE MANAGEMENT SYSTEM		GIANT LEAP CONSTRUCTION SDN. BHD.				SAFETY EQUIPMENT INSPECTION							
TOWER CRANE DAILY INSPECTION													
Nota : Jika ada kerosakan sila nyatakan dihaluan sebelah belakang		NO. KREN :											
		JENIS KREN :		NO. PMA									
		Tarikh :											
Nama :													
		OK	Tidak	OK	Tidak	OK	Tidak	OK	Tidak	OK	Tidak	OK	Tidak
<b>Bil</b>		<b>Perkara</b>											
<b>SEBELUM OPERASI</b>													
1	Janakuasa												
	Air												
	Pelincir												
	Pembumian "Earthing"												
2	Kabel elektrik												
3	Starter leg												
4	Tangga menaik												
5	Skr / pesak												
6	Drum hoist												
7	Cable hoist												
8	Motor hoist												
9	Kotak gear												
10	Slewing motor												
11	Slewing table												
12	Wire sheave												
13	Trolley motor												
14	Trolley roda												
15	Kunci peranti had boom												
16	Alat pemadam api												
<b>PERMULAAN OPERASI</b>													
16	Blok dan hook												
17	Trolley speed												
18	Trolley brake												
19	Hoist speed												
20	Hoist brake												
21	Boom speed												
22	Boom parking brake												
23	Peranti had pusingan boom												
24	Suis had beban												
25	Suis had hoist												
26	Suis had trolley												
27	Lampu kren												
28	Spotlight												
29	Hon												
30	Siren												
<b>SELEPAS OPERASI</b>													
31	Penyambar kilat												
32	Kebersihan kabin												
33	Kunci kabin												
34	Lampu isyarat												
35	Suis mematikan operasi kren												
Tanda tangan operator kren													
<b>PENGAKUAN :</b>		Pemeriksaan telah dilakukan terhadap peranti had yang di pasang untuk pusingan boom, beban, hoist dan trolley adalah :											
	(B) Peranti	Berfungsi	Tidak berfungsi										
	1) Had Pusingan Boom												
	2) Had Trolley												
	3) Had Beban												
	4) Had Hoist												
Nama Pemeriksa :						Tandatangan				Tarikh			



# **CHAPTER 25**

# **HOUSEKEEPING**

## Chapter 25 Housekeeping

### 25.1 Introduction

Effective housekeeping can help control or eliminate workplace hazards. Poor housekeeping practices frequently contribute to incidents. If the sight of paper, debris, Housekeeping is not just cleanliness. It includes keeping work areas neat and orderly, maintaining halls and floors free of slip and trip hazards, and removing of waste materials (e.g., paper, cardboard) and other fire hazard materials from work areas. It also requires paying attention to important details such as the layout of the whole workplace, aisle marking, the adequacy of storage facilities, and maintenance. Good housekeeping is also basic part of incident and fire prevention.

Effective housekeeping is an on-going operation. Housekeeping must be done daily basis.

### 25.2 Objective

The objectives of this chapter are:

- a) Understand the importance of housekeeping.
- b) Planning the best plan for controlling hazard by housekeeping.
- c) Ensure workspaces are neat and tidy.
- d) Understand the element to ensure success housekeeping programme.
- e) Alert and inform the building and construction industry on the potential of injuries to workers from housekeeping hazards
- f) Providing a good workplace environment and increase morale of the workers.

### 25.3 Definition

- a) **Combustible dust** – combustible particulate solid that presents a fire or deflagration hazard when suspended in air or some other oxidizing medium over a range of concentrations, regardless of particle size or shape.
- b) **Deflagration** - propagation of a combustion zone at a speed that is less than the speed of sound in the unreacted medium
- c) **Explosion** – the bursting or rupture of an enclosure or a container due to the development of internal pressure from deflagration.
- d) **Budgeting** – Act of creating a management system used for the allocation of resources over a given period of time.
- e) **Chemical agent** – A chemical added to a solution in the correct dosage that will kill bacteria, or at least stop their growth.

- f) **Coordinating** – Relating the efforts of employees in the most effective combinations. An activity of directing.
- g) **Housekeeping day** – That period of a 12-hour day when the housekeeping is done for all site area usually start from 8.30 a.m until 8.30 p.m
- h) **Safety data sheets (SDS)** – Informational sheets available from manufacturers of chemicals that describe the toxic effects of these chemicals and the proper procedures to use when handling them. The HazComm Standard demands that these sheets be made available to all employees who may exposed to a potentially hazardous chemical.
- i) **Recycling** – Breaking a product down to its essential elements and making a new product.

## 25.4 Legal Requirement

Factory and Machinery Act 139:

- a) Safety Health and Welfare Regulation 1970
  - i. Regulation 6 : Floor
  - ii. Regulation 7 : Access to workplace
  - iii. Regulation 8 : Opening generally to be fence
  - iv. Regulation 11 : Catwalk, runway or gangway
  - v. Regulation 12 : Working at height
  - vi. Regulation 14 : Dangerous liquid
  - vii. Regulation 15 : Containers for volatile inflammable substances
  - viii. Regulation 19 : Object on inclines
  - ix. Regulation 20 : Stacking of material
  - x. Regulation 23 : Cleanliness
  - xi. Regulation 24 : Space between each person
  - xii. Regulation 36 : Washing facilities
  - xiii. Regulation 37 : Sanitary convenience
  
- b) Building Operations and Works of Engineering Construction 1986
  - i. Regulation 8 : Slipping hazards
  - ii. Regulation 9 : Tripping and cutting hazards
  - iii. Regulation 10 : Access to workplace
  - iv. Regulation 11 : Dust and gases
  - v. Regulation 12 : Corrosive substance
  - vi. Regulation 15 : Protective apparel
  - vii. Regulation 16 : Electrical hazard
  - viii. Regulation 17 : Power driven saws

- ix. Regulation 20 : Illumination of passageways
- x. Regulation 21 : Storage of materials and equipment
- xi. Regulation 22 : Disposal of debris
- xii. Regulation 25 : Site safety supervisor
- xiii. Regulation 26 : Contractor's safety supervisor
- xiv. Regulation 27 : Safety committee
- xv. Part V : Cleaning, repairing and maintenance of roof, gutters, windows, louvers and ventilators
- xvi. Part VII : Chutes, safety belts and nets
- xvii. Part XIII : Material handling and storage, use and disposal

## 25.5 Type

Housekeeping can be divided into few part which is:

- a) **General housekeeping** – Housekeeping focusing on the open or outdoor area in the construction site including podium, car parks, toilet and etc.
- b) **Work area housekeeping** – Focus on the working area such as aluminium assembly work area, rebar installation area, cutting area, architectural work and etc.
- c) **Water ponding housekeeping** – Housekeeping works focusing on removing the water ponding at the site to disposed mosquito breeding area.
- d) **Housekeeping day** – A day for all the workers to focusing on housekeeping to ensure clean environment.
- e) **Material housekeeping** – housekeeping focusing on clearing all the material waste and stacking up the material that still in used.
- f) **Storage housekeeping** – Housekeeping focus on clearing the storage area from debris, rubbish, and staking material to ensure proper stacking and cleanliness of the storage.

## **25.6 Procedure**

### **25.6.1 Good Housekeeping**

There are three key factors to good housekeeping. They are:

*a) Overall cleanliness and orderliness*

- i. No matter the level of occupancy, a company can improve the conduciveness, hygiene and safety of its work environment by keeping all its work areas clean, organised and uncluttered.
- ii. This can be achieved through regular housekeeping, timely disposal or removal of items that are seldom used or no longer needed.

*b) Adequate space and proper layout*

- i. Work activity requires space and the presence of people, equipment and materials tend to obstruct orderly movement throughout the premises.
- ii. A careful review of space requirements based on actual operations may suggest ways for a better layout.
- iii. A well-designed work space with equipment arranged for optimum workflow will improve efficiency and productivity, as well as the ease with which work activities can be carried out.

*c) Correct storage and materials handling*

- i. Proper storage and handling equipment (e.g., engineered shelving, forklifts, handling robots, and conveyor systems) are necessary to facilitate the movement and placement of materials in a factory, construction site or storage facility.
- ii. This will prevent haphazard storage which can lead to blocked exit paths and/ or obstructed access to fire control equipment (e.g., fire extinguishers, fire hose reels).
- iii. Poorly organised storage may also result in the accumulation of unwanted items, debris and/ or waste materials especially in any available vacant space.
- iv. Good housekeeping will ensue once all the above factors are addressed. A neat and tidy workplace can be achieved and sustained when a routine is established for each factor.

## 25.6.2 Responsibility for Housekeeping

Good housekeeping is everyone’s responsibility. Keeping a workplace safe, clean and clutter free is an ongoing activity in which all employees have to do their part (see Table 1).

<b>Prevent slips, trips and falls.</b>	<ul style="list-style-type: none"> <li>• Do not stack items along walkways or passageways.</li> <li>• Put away or elevate the electrical cords and water or air hoses</li> <li>• Put away tools and keep drawers closed.</li> </ul>
<b>Limit spills</b>	<ul style="list-style-type: none"> <li>• Clean up spills immediately.</li> <li>• Repair leaks as soon as possible.</li> <li>• Sweep up debris.</li> </ul>
<b>Ensure machine safety.</b>	<ul style="list-style-type: none"> <li>• Inspect machines and ensure that all guards are in place before use</li> <li>• Keep area around machines clear</li> <li>• Put away tools</li> <li>• Clean machines regularly.</li> </ul>
<b>Prevent fires.</b>	<ul style="list-style-type: none"> <li>• Store flammable or combustible liquids in labelled and closed containers.</li> <li>• Keep flammable or combustible materials away from sources of ignition.</li> <li>• Keep electrical equipment clean.</li> <li>• Inspect electrical cords before use.</li> </ul>
<b>Ensure exits and access routes to fire equipment are clear.</b>	<ul style="list-style-type: none"> <li>• Do not block emergency exits.</li> <li>• Keep evacuation routes clear.</li> <li>• Check that fire extinguishers are accessible.</li> <li>• Ensure that electrical panels can be opened.</li> </ul>

Table 1: Examples of housekeeping responsibilities.

- a) Active participation from various teams of employees is required for housekeeping to be effective.
- b) Companies will need to provide the necessary resources (e.g., time and supporting infrastructure) and develop a disciplined and systematic approach to housekeeping so that employees will be able to carry out their housekeeping duties as part of daily routine.

### **25.6.3 General Housekeeping**

Good housekeeping is important outdoors as it is indoors (i.e. inside a building or rebar area).

- a) Good housekeeping not only reduces workplace accidents and injuries. It is also a critical aspect of fire safety.
- b) Outdoor storage areas should be located at sufficient separation distances from buildings and other combustible storage to prevent fire spread.
- c) This is because the accumulation of stored items (including waste) can present a fire load sufficient to cause damage to buildings as well as outdoor facilities and equipment.
- d) Housekeeping focuses on maintaining the separation by prohibiting even the temporary introduction of structures or objects such as shelters, discarded crates, or other combustibles.
- e) If materials and equipment are stored outdoors, good housekeeping requires that combustibles and obstructions are kept out of the passageways between storage piles.
- f) Keeping passageways clear will allow easy access for firefighting in the event one break out.
- g) Proper housekeeping also requires the prohibition of smoking in areas used for outdoor storage of flammable materials.
- h) Companies should provide suitable warning signs and non-combustible receptacles for smokers to dispose smoking materials before entering a “No Smoking” zone.
- i) The regular inspection of work premises and subsequent correction of irregularities are part of good housekeeping. Irregularities may refer to situations that are not right (e.g. a blocked passageway) or things that are out of place (e.g. a misplaced tool).

### **25.6.4 Safe Work Practice**

Supervisors and workers will implement the following safe work practices for housekeeping in all areas of the facility.

#### **a) All Working Surfaces**

- i. Keep all walking and working surfaces clean, sanitary, and orderly.
- ii. Keep work surfaces dry.
- iii. Clean up small spills immediately; report large spills to a supervisor.
- iv. Ensure that all walking and working surfaces and passageways are free from protruding nails, splinters, holes, or loose boards.

**b) Floors**

- i. Provide warning signs for wet floor areas.
- ii. Clean up small spills immediately; report large spills to a supervisor.
- iii. Use no-skid waxes and surfaces coated with grit to create nonslip surfaces in slippery areas such as toilet and shower areas.
- iv. Immediately clean up all spilled hazardous materials or liquids according to hazardous material spill response procedures.
- v. Immediately repair, cover, or otherwise make safe any holes in the floor or other walking surface.
- vi. Re-lay or stretch carpets that bulge or have become bunched to prevent tripping hazards.
- vii. Promptly remove combustible scrap, debris, and waste, and discard them according to the waste disposal procedures.
- viii. Keep toilets and washing facilities clean and sanitary.
- ix. Eliminate uneven floor surfaces.

**c) *Wet Floors and Water Ponding***

- i. Where wet processes are used, ensure that drainage channels are kept clear and that dry standing places such as mats are provided.
- ii. Use waterproof footwear to decrease slip and fall hazards in areas that are frequently wet.
- iii. Restrict or control access to wet floors or cover them with nonslip materials.
- iv. Water ponding must be drain to eliminate mosquito breeding area.
- v. If the water ponding cannot be drain, larvae seeding and “bunjut” must be done to prevent mosquito breeding.

**d) Aisles and Passageways**

- i. Keep aisles and passageways clear and marked as appropriate.
- ii. Tape or otherwise anchor to the floor temporary electrical cords that cross aisles.
- iii. Clean only one side of a passageway at a time.
- iv. Ensure there is safe clearance for walking in aisles where motorized or mechanical handling equipment is operating.
- v. Store materials or equipment in such a way that sharp projections will not interfere with or protrude into aisles or passageways.
- vi. Clean up small spills immediately, and report large spills to a supervisor.
- vii. Arrange aisles or walkways that pass near moving or operating machinery, welding operations, or similar operations so that employees will not be subjected to potential hazards.

**e) Elevated Surfaces**

- i. Pile, stack, or rack material on elevated surfaces in a manner that will prevent the material from tipping, falling, collapsing, rolling, or spreading.
- ii. Use dock boards or bridge plates when transferring materials between docks and trucks or railcars.

**f) Entryways and Exits**

- i. All entryways and exits will be kept clean, dry, and clear of all obstructions.
- ii. Follow the housekeeping requirements in the Fire Exits section of this Plan.

**g) Stairs**

- i. All stairways will be kept clean, dry, and free of debris.
- ii. No accumulation of any material will be allowed on stairs or in stairways or stairwells.

**h) Lighting**

- i. Ensure that all halls and stairwells are well lighted to help reduce accidents and promote security.
- ii. Replace light bulbs and/or fixtures as necessary to maintain adequate lighting at all times.

**25.7 5S Concept and Housekeeping**

5S is a workplace organization method based on a Japanese quality management concept companies may use to achieve a clean and organized workplace. Through a systematic approach, 5S offers opportunities for continual improvement and enhanced workplace efficiency and effectiveness.

**5S Element are:**



**a) Benefits of implementing a 5S programme include:**

- i. Workplace becomes clean and better organised.
- ii. Operations become more efficient and productive
- iii. Product and/ or service quality improves with fewer rejects or complaints
- iv. Results are visible to everyone (visitors included)
- v. Employees become more aware of the importance of housekeeping and personal discipline

- vi. Employees achieve a greater sense of pride in their work and workplace, and take on higher ownership of their work responsibilities
- vii. Workplace becomes safer
- viii. Company image is enhanced resulting in more business opportunities.

### **25.7.1 Management Role in 5S Implementation**

Management plays a critical role in ensuring the successful implementation of a 5S program. Proposed activities for driving the 5S implementation include:

- a) Communicating top management's commitment Companies need to identify areas top management can communicate its commitment to 5S. Possible ways include:
  - i. Publicising management philosophy of 5S to all staff (e.g., through a speech or memo)
  - ii. Organising awareness talks on 5S and holding staff meetings on 5S
  - iii. Providing 5S training to all employees
  - iv. Allocating official time for daily or weekly 5S activities
  - v. Sharing key business challenges with frontline management and highlighting how 5S may be applied as a solution to these challenges
  - vi. Conducting regular management walkabouts.
  
- b) Setting up a 5S steering committee
  - i. A 5S steering committee may be set up to oversee and drive the implementation of a 5S programme company-wide.
  - ii. Responsibilities charged to the committee include setting 5S goals and targets, creating a 5S operational structure (e.g., comprising a main committee and any supporting sub-committees), planning and implementing the 5S programme, and promoting 5S company-wide.
  - iii. To set the pace and provide overall direction for the programme, at least one top management representative should be included in the steering committee.
  
- c) Developing a 5S implementation plan
  - i. The steering committee may map out an implementation plan to determine the line-up of 5S activities and resources required to carry them out.

See Table 2 for a list of suggested activities that can be included into a 5S program.

	5S Activity	Month												
		1	2	3	4	5	6	7	8	9	10	11	12	
1	Top management announcement.	■												
2	Set up 5S steering committee.	■												
3	5S promotion (talks, banners, etc).		■											
4	5S basic training.		■	■										
5	5S launch ceremony.				■									
6	5S poster competition.				■									
7	Inter-department 5S competition.				■	■	■							
8	5S department evaluation.							■						
9	5S advanced training.								■					
10	Visits to other 5S companies.								■	■	■			
11	5S projects.									■	■	■		
12	5S programme review.												■	■

Table 2: Example of a 5S implementation plan.

## 25.7.2 Implementing 5S

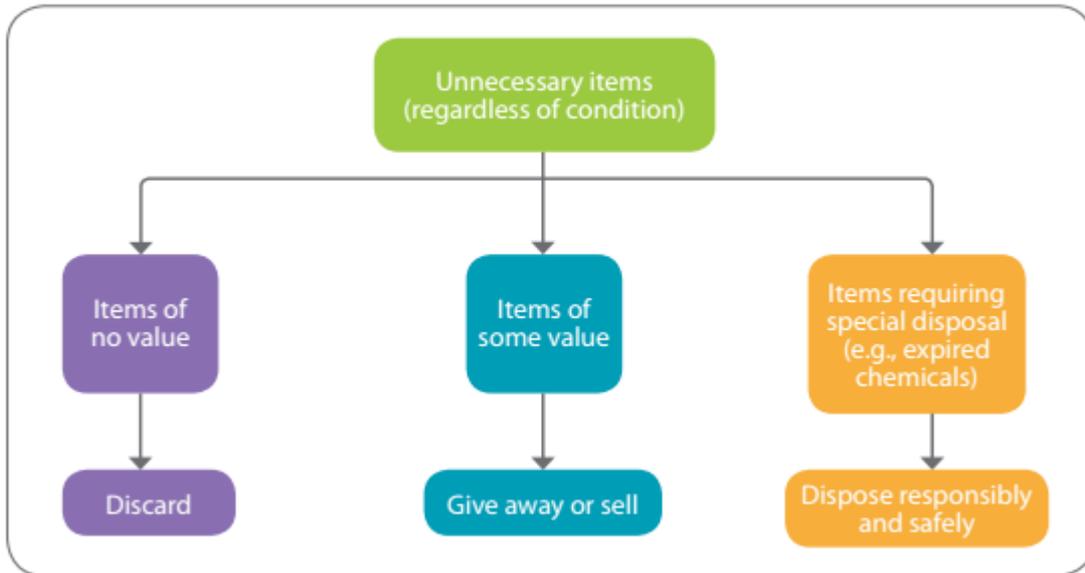
### 25.7.2.1 Sort

*Action required:* Separate unnecessary from necessary items and remove unnecessary items.

Sorting is about knowing what to keep and what to remove or discard. This includes machines, equipment, furniture and inventory. By removing unnecessary items, valuable industrial or commercial space can be put for better use, paving the way for 5S-2 Straighten.

This process can be achieved by:

- a) Discard items that are clearly no longer necessary or of use
- b) Evaluate items that are potentially unnecessary



Example of discarding items

### 25.7.2.2 Straighten (Set in Order)

*Action required:* Organize for better workflow and store necessary items for easy retrieval.

Straighten refers to organizing and labeling necessary items (e.g., tools, equipment and materials) so that they can be easily found, retrieved or returned to its original location. 5S-2 Straighten (set in order) is a prerequisite to implementing 5S-4 Standardize

This process can be achieve by:

- a) Arrange necessary items for better workflow.
  - i. Proper and neat storage will eliminate or significantly reduce the time taken to look for things.
- b) Create visual order. Vision controls refer to any means used to:
  - i. Provide visual instructional guidance on how a task should be carried out
  - ii. Display operating or progress status in an easy-to-see format
  - iii. Make the abnormality or deviation from the desired standard easy to identify.

### 25.7.2.3 Shine

*Action required:* Keep workplace clean, tidy and in good condition.

The concept of 5S-3 Shine covers both cleaning and inspection. Cleaning and inspection go hand in hand as an inspection is always carried out before cleaning an area or a machine. Emphasis is on removal of dirt and grime from the workplace.

With the implementation of 5S-3 Shine, cleaning should become an ingrained part of daily work habits, so that tools, machines and work areas are ready for use. This process can be achieved by:

- a) Determine target areas for cleaning or inspection. Workplace target areas may include the following:
  - i. Workspace: Floors, walls, walkways, materials, windows, lights, and etc.
  - ii. Equipment: Machines, tools, instruments, tables, stairs, working platform and etc.
  - iii. Warehouse or storeroom: Raw materials, parts, intermediate and finished products, etc.



Pipe stacker



Wood beam, template stacked

- b) Assign cleaning or inspection duties. This can be done by:
  - i. *Assignment Map:* Assignment Map will provide an overview of all the work zones at a specific workplace and indicate the person(s) responsible for it.
  - ii. *Schedule:* Schedule may be used to list (in table format) the day, time and workers responsible for each work zone.

- c) Establish the cleaning or inspection method.
  - i. Shine activities should include cleaning or inspection before work starts, during work and after work is done.
  - ii. Provide sufficient time for cleaning or inspection duties so that these activities become a natural part of everyone's daily routine.
  - iii. The cleaning or inspection method should include information on the cleaning tools (i.e., the supplies and equipment used), and cleaning standards (i.e., the procedure to follow and level of cleanliness to be achieved).
  
- d) Carry out the cleaning or inspection

#### **25.7.2.4 Standardize**

*Action required:* Create standards to make Sort, Straighten and Shine a habit.

5S-4 Standardize refers to strategies used to ensure that 5S-1 Sort, 5S-2 Straighten and 5S-3 Shine are always implemented and actively practiced throughout a company. Standardization requires the set-up of a consistent and systematic way to carry out tasks and procedures. 5S standardization is the result when Sort, Straighten and Shine are in place and maintained.

This can be done by:

- a) Set up a S3 duty chart.
- b) Develop S3 standard operating procedures.
- c) Establish the S standards. 3 operating standard.

#### **25.7.2.5 Sustain**

*Action required:* Maintain the standard and implement initiatives to sustain 5S activities.

A 5S program helps companies to achieve better workplace organization, enhanced productivity and workplace safety and health improvement. All employees must be involved in order for a 5S program to succeed. To sustain a 5S program, good housekeeping must not be just a chore that has to be done. It has to be something deeply embedded in a company's culture; something that everyone believes can bring about improvement in their daily work.

Steps a company can take to achieve 5S-5 Sustain include:

- a) Establish and implement a 5S internal audit system.
- b) Implement 5S initiatives for continued employee engagement.

Area of Impact	Suggested Initiatives
<p><b>Training</b></p>	<p><b>Basic 5S Training</b> Initial training for those new to the concept of 5S and good housekeeping.</p> <p><b>Advanced 5S Training</b> Follow-up training focusing on industry practice in 5S implementation and the concept of preventive Sort, preventive Straighten and preventive Shine.</p> <p><b>Refresher Training</b> This is recommended at regular intervals (e.g., every 2 to 3 years) for employees to revisit 5S fundamentals, learn from colleagues across departments and seek inspiration as they brainstorm for new 5S projects.</p>
<p><b>Awareness and Communication</b></p>	<p><b>5S Slogans</b> These are short and memorable phrases to promote good housekeeping and/ or communicate 5S concepts (e.g., “Do your Best, Follow 5S”, “5S Begins with Removing Excess”, “A Place for Everything, Everything in its Place” or “Good Housekeeping Promotes Safety”). Slogans can be displayed on banners, posters, stickers, and so on.</p> <p><b>5S Banners and Posters</b> These may be used to display 5S slogans, description of 5S activities or results or status of 5S activities. Using banners and posters is a good method to create awareness and/ or remind workers as they can be displayed anywhere in the workplace (e.g., on noticeboards, walls, fences, machines, etc.).</p> <p><b>5S Pocket Manual or Handbook</b> This is a pocket booklet (small enough to fit into a shirt pocket) containing a summary of what 5S is all about. Every employee can use the pocket manual as a quick reference to 5S essentials whenever necessary.</p>
<p><b>Continuous Learning</b></p>	<p><b>5S In-house Seminars</b> These are internal talks or sharing sessions on 5S typically given by 5S champions or project leaders on their implementation journey and status, challenges faced, and how</p>

**Creativity  
and Innovation**

problems were overcome.

**5S Projects**

This involves setting up 5S project teams to work on housekeeping projects, identifying necessary resources (e.g., manpower, time, funds) and putting ideas into action.

**Awards and  
Recognition**

**5S Rewards**

This involves setting up a reward system for departments, teams and individuals with good 5S performances. In particular, rewards are due to those with good 5S implementation and recommendations, those who have won 5S competitions and those who have done well in a 5S audit. Rewards may be offered on monthly or quarterly basis and take the form of an award or management commendation, cash bonuses or items such as meal vouchers.

## 25.8 Fire and Explosion Prevention.

Flammable and combustible materials and residues will be controlled so that they do not cause or contribute to a fire emergency.

### 25.8.1 Maintenance of Ignition Sources

Equipment and systems installed on heat- or ignition-producing equipment and processes will be maintained to prevent the accidental ignition of flammable and combustible materials.

#### **a) Dry Combustibles**

- i. Keep combustibles such as paper, cardboard, wooden pallets, or rags in designated locations away from ignition sources. The accumulation of such material provides a place for a fire to start and spread quickly.

#### **b) Extension Cords**

- i. Electric extension cords will be inspected before each use and kept in good condition.
- ii. Employees will not yank cords from electrical outlets.
- iii. Tools and equipment that require grounding will be of the three-wire grounded-connection type.
- iv. Never use extension cords to replace permanent wiring.
- v. If an extension cord is used for temporary wiring, it must be listed by Underwriters Laboratories or another recognized testing laboratory.

- vi. Avoid kinking or excessive bending of the cord; broken strands may pierce the insulated covering and become a shock or short-circuit hazard.

## 25.8.2 Flammable and Combustible Liquid Storage

### a) *General Safe Work Practices*

- i. No open flames, smoking, sparks, or welding will be allowed in storage areas with flammable liquids.
- ii. Electrical equipment must be explosion-proof if flammable or combustible liquid will be stored near such equipment.
- iii. Keep flammable and combustible liquids away from direct sunlight and stored in a cool, dry place.
- iv. The storage area must be well ventilated to prevent vapors from building up; the vents should be from floor to ceiling.
- v. Store oxidizers and other incompatible materials away from flammable and combustible liquids to prevent a dangerous reaction.
- vi. Use secondary containment methods to make sure any spills are contained.
- vii. Return flammable and combustible liquids to their storage location immediately after use.



Combustible gas storage

### b) *Containers*

- i. Store flammable and combustible liquids in approved fire-resistant containers with self-closing lids. Ensure that such containers are grounded and bonded during any transfer of flammable or combustible liquids between containers. These containers prevent sparks and other ignition sources from

igniting the liquids stored in them. Keep the containers closed when not in use.

- ii. **Used rags.** Put rags soaked with flammable or combustible liquids in approved, closed containers. The containers must be kept closed to prevent vapour build-up.

**c) Reactive Materials**

- i. Do not store reactive materials near one another. Reactive materials, when mixed, often create an exothermic reaction, which produces heat and could cause these materials to spontaneously combust.

**d) Electrical and Hot Equipment**

- i. Keep combustible materials, dust, and grease away from electrical equipment and hot machinery.
- ii. Maintain a clear access to electrical panels at all times so that they can be opened quickly in case of an emergency that requires the power to a machine or the building to be shut down.

**e) Fire Exits**

- i. Always keep evacuation routes clear.
- ii. Don't store boxes or other items in aisles, hallways, or stairwells that lead to emergency exits.
- iii. Ensure that exit doors are kept clear on both sides so that they can be easily opened in an emergency.

**f) Fire Extinguishers**

- i. Fire extinguishers will not be used as hangers for coats, air hoses, electrical cords, or anything else.
- ii. Access to extinguishers will be kept clear at all times.
- iii. Extinguishers will always be kept visible. They will not be blocked by stacks of boxes, forklifts, or other items.

**g) Combustible Dust**

Combustible dusts that accumulate on surfaces can cause a deflagration, other fires, or an explosion. Combustible dusts are often either organic or metal dusts that are finely ground into very small particles, fibers, fines, chips, chunks, flakes, or a small mixture of these. These dusts include, but are not limited to:

- i. Metal dust, such as aluminum and magnesium
- ii. Wood dust
- iii. Coal and other carbon dusts
- iv. Plastic dust and additives
- v. Bio solids
- vi. Other organic dust, such as sugar, flour, paper, soap, and dried blood

- vii. Certain textile materials

### **25.8.3 Criteria for Dust Cleanup**

Immediate cleaning and collection of accumulated combustible dust is warranted whenever a layer of combustible dust 1/32-inch thickness (i.e., approximately the thickness of a typical paper clip) accumulates over a surface area of at least 5 percent of the floor area of the facility or any given room.

The 5 percent factor will not be used if the floor area exceeds 20,000 square feet (sq. ft.), in which case a 1,000 sq. ft layer of dust is the upper limit. Accumulations on overhead beams, joists, ducts, the tops of equipment, and other surfaces should be included when determining the dust coverage area. Vertical surfaces will be included if the dust is adhering to them. Likely areas of dust accumulations within a plant are:

1. Structural members
2. Conduit and pipe racks
3. Cable trays
4. Floors
5. Above the ceiling
6. On and around equipment (leaks around dust collectors and ductwork)

#### ***a) Procedures for Dust Cleanup***

- i. Routinely remove accumulations of combustible dust from elevated surfaces, including the overhead structure of buildings. Accumulations will be removed and collected in dust collectors.

#### ***b) Hot Work Near Dust Collection Points***

- i. The contractors will ensure that approved hot work permits are issued for any hot work in areas where hazardous levels of dust accumulations may occur. In addition, anyone who performs combustible dust collection operations near hot work on and around collection points and ductwork must receive written approval to perform such work from the issuer of the hot work permit. Dust collection operations will not be conducted while hot work operations are in progress.

### **25.9 Waste Recycling and Disposal**

The contractors will ensure that the following waste recycling and disposal procedures are implemented in all work areas where such waste is generated:

- a) Scrap materials will be collected and sorted for recycling or disposal.
- b) Scrap containers will be placed near areas where the waste is produced to encourage orderly waste recycling or disposal.

- c) All waste receptacles will be clearly labeled (e.g., recyclable glass, plastic, and metal, toxic, flammable).
- d) All waste containers will be emptied.
- e) Covered metal waste cans will be provided for oily or paint-soaked waste.

## 25.10 Hazardous Chemical Spill Control



The contractors will implement procedures for the cleanup of large and small hazardous chemical spills at the facility. Large spills will be managed according to the facilities

### 25.10.1 Spill Prevention Safety Plan

#### a) Spill Prevention

Regularly cleaning and maintaining machines and equipment are ways to do this. Others are to use drip pans and guards where possible spills might occur.

#### b) Small Spills

The following procedure will be followed by all employees when a small chemical spill less than has occurred:

- i. Notify *Safety Department*.
- ii. If toxic fumes are present, secure the area (with caution tape or cones) to prevent other personnel from entering.
- iii. Deal with the spill in accordance with the instructions described in the safety data sheet (SDS).
- iv. Small spills must be handled in a safe manner while wearing the proper PPE.
- v. Use absorbent material to wipe up greasy, oily, or other liquid spills.
- vi. Absorbents must be disposed of properly and safely.

## 25.11 Electrical Parts and Equipment

Employees will not perform housekeeping duties near live electrical parts where there is a possibility of contact, unless adequate safeguards such as insulating equipment or barriers are provided. **(Refer to Chapter 16 Mechanical and Electrical)**

Electrical equipment will be kept free of dust, debris, and grease.

### a) Cleaning Materials

Electrically conductive cleaning materials, including conductive solids such as steel wool, metalized cloth, and silicon carbide, as well as conductive liquid solutions, will not be used near energized parts unless written procedures authorized by the contractors that will prevent electrical contact are followed.

## 25.12 General Storage

The contractors will ensure that the following general material storage procedures are implemented:

- a) Store or stack materials to allow a clear space of 3 feet or more under water sprinkler heads.
- b) Stack cartons and drums on a firm foundation and cross-tie them where necessary to reduce the chance of their movement.
- c) Do not allow stored materials to obstruct aisles, stairs, exits, fire equipment, emergency eyewash fountains, emergency showers, or first aid stations.
- d) All storage areas will be clearly marked.



Aerated concrete brick stacked	Reinforced semi-finished products stacked three-dimensional map
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### **25.13 Machines and Tools**

#### **a) Machines**

- i. Keep the area around machines clear of combustibles, slip and trip hazards, or any other debris.
- ii. Inspect machines before use.
- iii. Ensure that all guards are in place and operating properly.
- iv. Follow lockout/tag out procedures when servicing or repairing a machine.
- v. When done using the machine put away tools and clean up both the machine and the work area.

#### **b) Hand and Power Tools**

- i. Store blades and sharp tools carefully so that they do not create a hazard when not in use.
- ii. Store new blades for band saws, circular saws, or utility knives in labeled boxes so someone doesn't accidentally stick his or her hands inside and get cut.
- iii. When it's time to discard an old blade, cover the sharp edge with tape or cardboard and discard the blade directly into a metal trash container or Dumpster.
- iv. Keep blades on utility knives sheathed or retracted when not in use.

### **25.14 Personnel Protective Equipment (PPE)**

The contractors will ensure the appropriate PPE is provided to and worn by employees performing housekeeping activities and that the PPE is in good condition.

PPE will not be used as a substitute for engineering, safe work practice, or administrative controls for preventing exposure to recognized physical or chemical hazards.

PPE for housekeeping operations include:

- a) Eye protection
- b) Gloves
- c) Proper shoes
- d) Dust masks

- e) Other items such as protective clothing, respirators, and hearing protection depending on the hazards

Employees involved in housekeeping activities will implement the following PPE use and care procedures:

- a) Inspect PPE before each use, checking for signs of wear or damage.
- b) Keep PPE clean.
- c) Store PPE properly according to instructions on labels or received during training to prevent damage or contamination from dirt or chemicals.
- d) Replace PPE when it is worn out, damaged, or no longer provides the protection that is required.

When performing housekeeping tasks, employees will select the right equipment for the job, including the right PPE. Employees must consult with a supervisor concerning appropriate PPE when starting a new job or housekeeping task.

### **25.15 Inspections**

Programs related to housekeeping will be regularly monitored to ensure a high standard of sanitation and safety in all work areas, as well as to identify deficiencies. The main contractors will conduct regular inspections of work areas to monitor hazards and ensure that housekeeping safe work practices are implemented.

The main contractors will develop housekeeping inspection schedules and checklists for each work area with specific hazards or work processes that differ from those found in the facility as a whole.

#### **a) Frequency of Inspections**

The frequency of inspections for each work area will be determined by identification of hazards and hazard control recommendations from hazard assessments, deficiencies identified in previous inspections, frequency of changes in work processes, and any other factors that may affect compliance with housekeeping requirements and policies.

At a minimum, inspections of all work areas will be conducted *twice a week*. Surprise inspections may be conducted at any time.

#### **b) Inspection Documentation**

Copies of inspection checklists or reports will be kept at *site office*. Each report will be maintained for *6 month* after the date of the inspection.

The main contractors will ensure that:

- i. All evacuation routes are clearly marked and unobstructed.
- ii. Access to fire extinguishers and other emergency equipment is unobstructed.
- iii. All emergency-related signs, placards, posters, notices, and markings are clearly visible and legible at all times.
- iv. All used emergency and fire-fighting equipment is replaced.

Post-emergency cleanup operations will be conducted by personnel trained and authorized to perform specific cleanup tasks.

### **25.17 Training**

*Safety Team will provide housekeeping training to all employees at the time of hire and as needed thereafter.*

Supervisors will provide safety meetings or talks to employees as a group every *once a week* and to individual employees who fail to follow safe procedures.

#### **a) Training Records**

Training will be documented with employee sign-in sheets, date of training, and the training session agenda.

### **25.18 Recordkeeping**

Copies of all hazard assessments and inspection checklists will be maintained at *the site office* until the project is done.



Generalize housekeeping team



Worker cleaning working area and stacking up materials.

# **CHAPTER 26**

## **HEALTH ISSUE**

## Chapter 26 Health Issue

### 26.1 Introduction

Prolonging working careers is major challenge for industries where physical work demands are high such as in construction industry. Compared to other industries, those with high physical work demand show higher ageing and higher shrinking rates of the working population. Insight into health problems at worksite, and effective measure regarding this problems, are helpful for prolonging the working careers of the construction worker.

### 26.2 Objective

The objectives of this chapter are:

- a) Understands the health issue usually encounter in construction site in Malaysia.
- b) Determine the cause of the disease.
- c) Control measure and emergency first aid that can be done.
- d) Ensure welfare of the workers.

### 26.3 Definition

- a) **Hygienic disease** – A disease cause by poor hygiene.
- b) **Occupational disease** - is any disease contracted primarily as a result of an exposure to risk factors arising from work activity.
- c) **Musculoskeletal disorder** – Injuries or pain in human musculoskeletal system including joint, ligament, muscle, nerve and etc.
- d) **Vector borne disease** – Illnesses caused by pathogens and parasites in human population which include ticks, mosquito and fleas.
- e) **Rash** – Braking out or eruption of the skin.
- f) **Heat stress** – is the overall heat load to which an employee may be exposed from the combined contributions of metabolic heat, environmental factors (i.e. air temperature, humidity, air movement, and radiant heat), and clothing requirements.
- g) **Ergonomic** – is the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human wellbeing and overall system performance.
- h) **Dermatitis** – an inflammation of the skin.

- i) **Pneumonia** – is an infection in one or both of the lungs.
- j) **Neurological system** – Complex network of nerves and cells that carry messages to and from the brain and spinal cord to various part of body.

## 26.4 Legal Requirement

a) Occupational Safety and Health Act 514:

- i. Section 15 : General duties of employers and self-employed person to their employees.
- ii. Section 24 : General duties of employees
- iii. Regulation 2000 :Use and Standards of Exposure of Chemicals Hazardous to Health (USECHH)

Factory and Machinery Act 139:

b) Safety Health and Welfare Regulation 1970

- i. Regulation 14 : Dangerous liquid
- ii. Regulation 23: Cleanliness
- iii. Regulation 25: Air cleanliness
- iv. Regulation 28: Temperature
- v. Regulation 31 : Work bench
- vi. Regulation 32: Working cloth, personal protective clothing
- vii. Regulation 34 : Drinking water
- viii. Regulation 36: Washing facilities
- ix. Regulation 38: First aid
- x. Regulation 39: Duty of occupier

c) Mineral Dust Regulation 1989

d) Occupational Safety and Health (Noise Exposure) 2019

e) Guidelines on Ergonomic Risk Assessment 2017

f) Guidelines for Manual Handling 2018

g) Act 342: Preventive and Control of Infectious Disease Act 1998

## **26.5 Procedure and Type**

### **26.5.1 Occupational Disease**

An occupational disease is a health condition or disorder (e.g., cancer, musculoskeletal disorders, post-traumatic stress, etc.) that is caused work environment or activities related to work. In general, health conditions or disorders that occur among a group of people with similar occupational exposures at a higher frequency than the rest of the population are considered to be occupational diseases.. Occupational diseases can be caused by:

- a) Biological agents- bacteria, viruses, fungi, parasites, insects, plants, birds, animals, humans, etc.
- b) Chemical agents- beryllium, lead, benzene, isocyanates, etc.
- c) Ergonomic issues- repetitive movements, improper set up of workstation, poor lighting, poor design of tools, etc.
- d) Physical agents - ionizing and non-ionizing radiation, magnetic fields, pressure extremes (high pressure or vacuum), extreme temperatures, noise, vibration, etc.
- e) Psychosocial issues- stress, violence, bullying, harassment, lack of recognition, etc.

There are other factors that determine the development of an occupational disease, including:

- a) Amount of exposure or dose entering the body
- b) Duration or length of exposure
- c) Route of entry into the body
- d) Toxicity of the chemical
- e) Removal from the body
- f) Biological variation (individual susceptibility)
- g) Effects of interaction, such as synergism (e.g., smoking, alcohol use, exposure to other chemicals).

Exposure to the hazardous agent may occur only once in a while or only in very small amounts, or the exposure may be daily and/or to very large amounts. The number of weeks or years on the job may provide an estimate of the degree of exposure. In general, the higher the exposure (duration and/or amount), the higher the risk of developing a health effect.

### **26.5.1.1 Heat Stress**

Many workers are exposed to heat on the job, in both indoor and outdoor heat environments. Operation involving high air temperatures, radiant heat sources e.g. sunlight, hot exhaust, high humidity and direct physical contact with hot object.

#### **Type**

Exposure to abnormal or prolonged amounts of heat and humidity without relief or adequate fluid intake can cause various types of heat related illness as the following:

a) Heat Rash.

Heat rash is the most common problem in hot work environments. It causes discomfort and itchiness. Heat rash is caused by sweating and looks like a red cluster of pimples or small blisters. Heat rash may appear on the neck, upper chest, groin, under the breasts and elbow creases.

b) Heat cramps

These are muscle pains usually caused by the loss of body salts and fluid during sweating. Workers with heat cramps should replace fluid loss by drinking water and/or carbohydrate electrolyte replacement liquids (e.g. isotonic drinks) every 15 to 20 minutes.

c) Heat Exhaustion

This is the next most serious heat-related health problem. Heat exhaustion is the body's response to an excessive loss of the water and salt, usually through excessive sweating. The signs and symptoms of heat exhaustion are headache, nausea, dizziness, weakness, irritability, confusion, thirst, heavy sweating and a body temperature greater than 100.4°F (38°C).

d) Heat Syncope

Heat syncope is a fainting (syncope) episode or dizziness that usually occurs with prolonged standing or sudden rising from a sitting or lying position. Factors that may contribute to heat syncope include dehydration and lack of acclimatisation. Symptoms of heat syncope include light-headedness, dizziness and fainting.

e) Heat Stroke

This is the most serious form of heat injury and is considered a medical emergency. Heat stroke results from prolonged exposure to high temperatures and usually in combination with dehydration, which leads to failure of the body's temperature control system. The medical definition of heat stroke is a core body temperature greater than 105 Fahrenheit (40.5°C), with complications involving the central nervous system that occur after exposure to high temperatures. Other common symptoms include nausea, throbbing headache, seizures, confusion, disorientation, and rapid, shallow breathing. Heat stroke can cause death or permanent disability if emergency treatment is not given.

f) Rhabdomyolysis

Associated with heat stress and prolonged physical exertion which result in rapid breakdown, rupture and death of muscle. Deaths of muscle tissue lead to increase in electrolytes and large protein in blood which cause irregular heart rhythm, seizure and damaged kidneys.

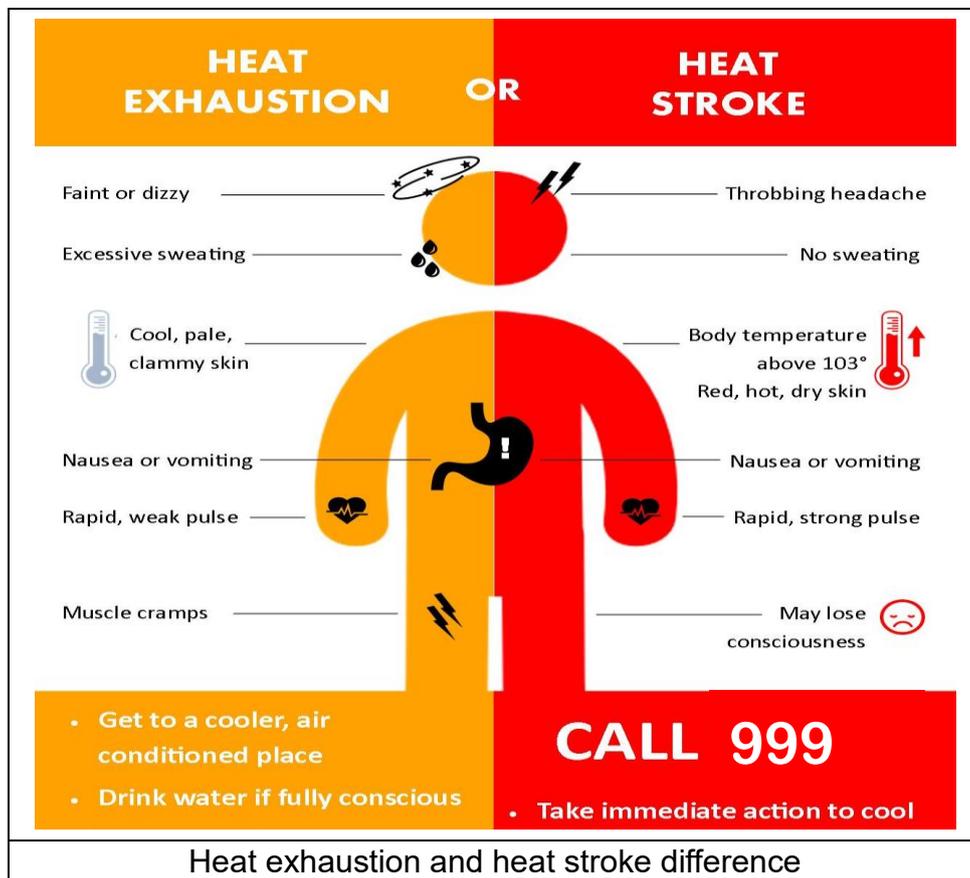
**Risk Factor**

The risk factor includes:

- a) Exposed to high temperature, humidity, direct sun exposure, no breeze or wind for long time
- b) Heavy physical labour
- c) Low liquid intake and dehydrated
- d) No recent exposure to hot workplaces
- e) Waterproof clothing

## Symptoms

- a) Heat stress can affect individuals in different ways, and some people are more susceptible to it than others. Typical symptoms are:
- b) An inability to concentrate
- c) Muscle cramps
- d) Heat rash
- e) Severe thirst - a late symptom of heat stress
- f) Fainting
- g) Heat exhaustion - fatigue, giddiness, nausea, headache, moist skin
- h) Heat stroke - hot dry skin, confusion, convulsions and eventual loss of consciousness. This is the most severe disorder and can result in death if not detected at an early stage



## Prevention and Control

- a) Identification of heat stress for example using Heat Stress Screening Checklist.
- b) Conduct heat stress monitoring to obtain WBGT index and compares them with the reference values of action limit and the Threshold Limit Value produced by The American Conference of Governmental Industrial Hygienists, Inc. (**ACGIH**).
- c) Heat stress evaluation and control based on risk decision.

The risk of heat-related stress depends on the WBGT. In general, the following criteria in Table 1 below can be used to make a decision on the severity of the risk.

RISK DECISION	
ADJUSTED WBGT VALUE	DECISION
WBGT adjusted < Action Limit	Low Risk
Action Limit < WBGT adjusted < TLV	Medium Risk
WBGT adjusted > TLV	High Risk

- a) Low Risk: There is a minimum risk of excessive exposure to heat stress
- b) Medium Risk: Implement general control as in **Table 2** which includes drinking of water and pre-placement medical screening.
- c) High Risk: Further analysis may be required. This may include monitoring heat strain (physiological responses to heat stress), sign and symptom of heat-related disorders. In addition, job-specific control should be implemented.

<b>LOW RISK (WBGT ADJUSTED &lt; ACTION LIMIT)</b>	<b>MEDIUM RISK (AL&lt;WBGT ADJUSTED&lt;TLV)</b>	<b>HIGH RISK (WBGT ADJUSTED &gt; TLV)</b>
<ul style="list-style-type: none"> <li>• Continue work</li> <li>• Monitor</li> </ul>	<ul style="list-style-type: none"> <li>• General Controls</li> </ul>	<ul style="list-style-type: none"> <li>• Implement all general control and applicable job specific control</li> <li>• Applicable Job Specific Control</li> </ul>
	<ul style="list-style-type: none"> <li>• Information, instructions and training</li> <li>• Regular drinks of water</li> <li>• Self-limitation to heat exposure</li> <li>• Health screening and surveillance                             <ul style="list-style-type: none"> <li>✓ Pre placement medical screening</li> </ul> </li> <li>• Encourage reporting symptoms to management</li> <li>• Encourage healthy life styles                             <ul style="list-style-type: none"> <li>✓ Diet</li> <li>✓ Exercise</li> </ul> </li> <li>• Monitor employees with existing medical condition</li> <li>• Personal protective equipment</li> <li>• Cool work rest area</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Engineering Controls</b> <ul style="list-style-type: none"> <li>✓ Reduce workers activity by providing mechanical aids</li> <li>✓ Enclose or insulate hot surfaces</li> <li>✓ Shield workers from radiant heat</li> <li>✓ Provide air conditioning</li> <li>✓ Provide adequate ventilation</li> <li>✓ Reduce humidity where applicable</li> <li>✓ Rapid cooling area</li> </ul> </li> <li>• <b>Administrative controls</b> <ul style="list-style-type: none"> <li>✓ Acclimatize workers</li> <li>✓ Supervision of workers</li> <li>✓ Work in pairs or groups</li> <li>✓ Ensure first aid is available</li> <li>✓ Established emergency procedure</li> <li>✓ Establish work- rest regime to minimize heat exposure</li> <li>✓ Provide and encourage regular intake of fluid/oral rehydration salt drinks</li> <li>✓ Dress appropriately</li> <li>✓ Changing the way of work is done</li> <li>✓ Regular health screening if required based on employee’s medical condition which includes physiological monitoring</li> </ul> </li> <li>• <b>Specific personal protective equipment</b> <ul style="list-style-type: none"> <li>✓ Cool vest</li> <li>✓ Reflective suit</li> <li>✓ Heat transfer suit</li> <li>✓ Cool bandanas</li> </ul> </li> </ul>

**Table 2: Control Measure**

### **First Aid**

- a) Check for worker awareness and consciousness
- b) Move worker to the cooler or shaded area.
- c) Remove outer clothing.
- d) Call supervisor or first aider at the site for help. If not available call for an ambulance.
- e) Fan and mist the worker with water or apply ice pack to the armpit, groin and shoulder to cool down the body temperature immediately.
- f) Provide cool drinking water if the worker able to drink.
- g) *IF THE WORKER LOST CONSIIOUSNESS, NOT ALERT OR SEEM CONFUSED THIS MAY BE A HEAT STROKE AND CALL FOR AN AMBULANCE IMMEDIATELY.*

### **26.5.1.2 Lung Disease**

Lung disease is any problem in the lungs that prevents the lungs from working properly. Occupational lung diseases are a broad group of diagnoses caused by the inhalation of dusts, chemical or proteins. The severity of the disease is related to the material inhaled and the intensity and duration of the exposure.

### **Type**

There are many type of occupational lung disease which includes:

- a) ***Pneumoconiosis*** – Disease cause by inhalation of any dust which lead to lung inflammation, coughing and fibrosis.
- b) ***Asthma*** – A respiratory disease that can begin or worsen due to exposure at work characterized by episodic narrowing of the respiratory tract.
- c) ***Bronchiolitis Obliterans*** – Known as constructive bronchiolitis or obliterative bronchiolitis cause by injury of the smallest airways called bronchioles. This can cause by inhalation of toxins and gases such as nitric oxides and fibreglass.
- d) **Chronic obstructive pulmonary disease (COPD)** – is a disease encompass chronic bronchitis or emphysema. This can occur due to exposure to silica and coal dust which can be found in mining, manufacturing and construction.
- e) ***Lung Cancer*** – Disease cause by mutation of the lung cell due to radiation, metal, dust or fibre exposure.

## **Risk Factor**

The risk factor includes:

- a) Smoking can decrease our defence mechanism toward an infection and worsen the occupational lung disease.
- b) Long exposure to toxin, mineral dust, chemical and fibre
- c) Workers not wearing or using proper PPE when dealing with the exposure.  
**(Refer to Chapter 21 : PPE)**

## **Symptoms**

- a) Coughing
- b) Shortness of breath, which often get worsen with activity
- c) Chest pain
- d) Chest tightness
- e) Abnormal breathing patterns

## **Prevention and Control**

- a) Preventing further exposure if diagnosed.
- b) Advice worker to not smoking as it increases the risk for occupational lung disease
- c) Advice worker to do at least one medical check-up a year to ensure healthy.
- d) Exposed worker with the needed information.
- e) Ensure workers are aware of their health risk when dealing with chemical and SDS must be provided and explain to the workers.
- f) Provide worker with the proper PPE such as facemasks or respirators when known to be exposed with the dust, chemical, toxin or fibre.

## First Aid

- a) Move worker to the safer area.
- b) Check for worker awareness and consciousness
- c) Call supervisor or first aider at the site for help. If not available immediately call for an ambulance.
- d) Do an ABCDE assessment for CPR for those who have training which mean:
  - i. **A – Airways.** Check if the airways are blocked or not and stabilize the cervical spine.
  - ii. **B – Breathing.** Check whether the worker is breathing. It can be done by putting finger on the nose or looking at chest movement.
  - iii. **C – Circulation.** Check the pulse.
  - iv. **D – Disability.** Ensure worker consciousness or any disability found in the body.
  - v. **E – Environment.** Protect the patient from environmental influences such as fumes, dust, rain and etc.
- e) *DO NOT DO **CPR** IF NOT WELL TRAINED AND WAIT FOR THE FIRST AIDER OR AMBULANCE TO COME.*

## Surveillance and Monitoring

- a) A company should monitor their workers' health especially to those who normally exposed to the disease agent.
- b) Health monitoring and surveillance should be done at **six months** period to ensure workers health.
- c) For those who are diagnosed with the lung disease should be located to other location to prevent further exposure.

**NOTE:** Refer to Factories and Machinery (Mineral Dust) Regulations 1989 requirements.

### 26.5.1.3 Disease Cause by Noise

Since there are many areas of human labor associated with the use of specific tools and machine that are subjected to noise, respectively, there is certain risk groups, which include workers who can develop a disease cause by this exposure.

The use of pneumatic power tools e.g.; driller, grinder, hacker and etc. is associated with noise.

#### Type

There is certain type of disease cause by noise which includes:

- a) **Damaged to Eardrums and Loss of Hearing** – Prolong exposure to noise more than 80dB more than 8hour can cause hearing loss and damaged eardrum.
- b) **Cardiovascular Issue** – Noise above 50dB could increase the risk of myocardial infarction (MI) by severely increasing cortisol production.
- c) **Stress** – Noise can cause irritability and restless that can lead to stress.
- d) **Hypertension** – Regular exposure to noise can elevates the blood pressure, possibly due to an increase if adrenaline level at being annoyed at the noise or associated with stress leading to heart problem.
- e) **Stroke** – People who exposed to noise can increase the risk having stroke. Stroke cause by blockage of the artery or bursting of the blood vessel causing disruption of the blood flow to the brain

#### Risk Factor

The risk factor includes:

- a) Prolong exposure to noise more than 82dB for noise for more than 8 hours period.
- b) Exposure to noise more than 115dB at any time.
- c) Workers not wearing or using proper PPE when dealing with the exposure.  
(Refer to Chapter 21 : PPE)

## **Symptoms**

- a) Bleeding on the ear
- b) Loss of hearing.

## **Prevention and Control**

- a) Identification of excessive noise where daily noise exposure level exceeding 82dB (A), max SPL exceeding 115dB (A) or peak SPL exceeding 140dB (A).
- b) Identify of excessive noise not more than one year after previous identification or if there is any changes in machinery, control measures and process.
- c) Carry out noise risk assessment for employees exposed to excessive noise by Noise Risk Assessor every 5 years.
- d) Employer to carry out such recommendations from noise risk assessment report within 30 days after receiving report.
- e) Provide information, instruction training and supervision for employees that exposed to excessive noise at least once a year.
- f) Reduction of noise exposure exceeding limit (NEL) where daily noise exposure level exceeding 85dB (A), max SPL exceeding 115dB (A) or peak SPL exceeding 140dB (A).
- g) Provides personal hearing protector to employees exposed to NEL.
- h) Provides hearing protection zone.
- i) Appoint Audiometric Testing Centre to carry out audiometric testing for employees exposed to NEL.
- j) Conduct baseline audiometric within three months after the employee commencing to work.
- k) Record of reports to be kept and maintain.

## **Surveillance and Monitoring**

- a) Conduct an audiometric testing by competent person.
- b) Provide a valid baseline audiogram.
- c) Record the medical and occupational history.
- d) Employer should monitor their workers' health especially to those who normally exposed to the disease agent.

- e) Audiometric testing should be carried out at least once a year period to ensure workers health.

#### **26.5.1.4 Disease Cause by Vibration.**

Vibration induced health conditions progress slowly. In the beginning it usually starts as a pain. As the vibration exposure continues, the pain may develop into an injury or disease. Pain is the first health condition that is noticed and should be addressed in order to stop the injury.

#### **Type**

There is certain type of disease cause by noise which includes:

- a) **Hand-Arm Vibration Syndrome (HAVS)** – Damaged that occur in the fingers, hand and arms when working with vibrating tools. It causes neurological injury, vascular injury, and musculoskeletal injury.
- b) **Vibration-Induced White Finger (VWF)** – Dead finger due to blockage of the blood circulation of the hand causing the finger to loss sensory and movement.
- c) **Fatigue** – Vibration cause workers to easily tired and restless.
- d) **Carpal Tunnel Syndrome** – Disease cause by pressure or compression on the hand nerve causing pain, numbness and tingling in the hand and arm.

#### **Symptoms**

<b>Stage</b>	<b>Symptoms</b>
OSN	Exposed to vibration but no symptoms
1SN	Intermittent numbness, with or without tingling
2SN	Intermittent or persistent numbness, reduced sensory perception
3SN	Intermittent or persistent numbness, reduced tactile discrimination and/or manipulative dexterity

- a) Tingling and numbness in the fingers which can result in an inability to do fine work (for example, assembling small components) or everyday tasks (for example, fastening buttons).
- b) Loss of strength in the hands which might affect the ability to do work safely.
- c) The fingers going white (blanching) and becoming red and painful on recovery, reducing ability to work in cold or damp conditions, e.g. outdoors.

### **Which tools are most likely to create a risk?**

Users of the types of equipment listed below and similar equipment will often be exposed above the exposure limit value EAV:

- a) Chainsaws
- b) Grinders (all types and sizes, e.g. angle, die, straight, vertical etc.)
- c) Hand-fed equipment, e.g. pedestal finishers, grinders, mops
- d) Impact drills
- e) Scaling hammers including needle scalers;
- f) Pedestrian controlled equipment including mowers, floor saws, floor polishers;
- g) Powered hammers for chipping, demolition, road breaking etc.
- h) Sanders and polishers;
- i) Hand-held saws for concrete, metal, ground clearance etc.

### **Control Measure**

Make sure that risks from vibration are controlled:

- a) Provide information, instruction and training to employees on the risk and the actions being taken to control risk
- b) Provide suitable health surveillance.
- c) **Reference: Guidelines on Occupational Vibration 2003.**
- d) Identification of risks areas.
- e) Conduct the assessment of exposure.
- f) Vibrations prevention and control including replacement of hazardous equipment, design and installation, working environment, PPE and reduction of exposure time.

The exposure action value (EAV) and an exposure limit value (ELV) based on a combination of the vibration at the grip point(s) on the equipment or work-piece and the time spent gripping it.

The exposure action and limit values are:

- i. A daily EAV of 2.5 m/s<sup>2</sup> A(8) that represents a clear risk requiring management

- ii. A daily ELV of 5 m/s<sup>2</sup> A(8) that represents a high risk above which employees should not be exposed.

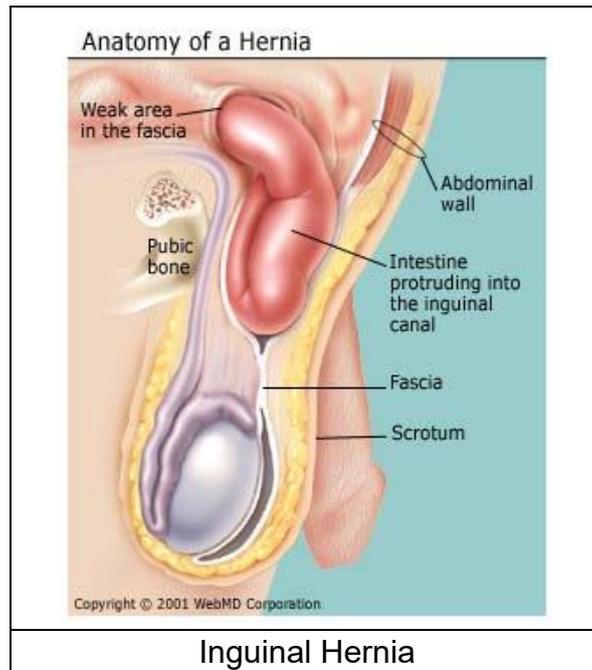
### 26.5.1.5 Ergonomic Disease

The goal of ergonomic is to prevent soft tissue injury and musculoskeletal disorder (MSD) caused by sudden or sustained exposure to force, vibration, repetitive motion, and awkward posture. Musculoskeletal disorders (MSD) are a common and costly problem for workers and company across Malaysia.

#### Type

There are many type of musculoskeletal disease which includes:

- a) **Tendonitis** – Disease cause by inflammation or irritation of a tendon, a thick cord that attach bone to muscle that cause painful swelling and tenderness around the muscle.
- b) **Tension Neck Syndrome** – Pain and stiffness of the neck and shoulder related to muscle fatigue or overuse.
- c) **Thoracic Outlet Compression** – Compression of nerve or vascular system in the passageway from the lower neck to the armpit causing pain, weakness and occasionally loss of muscle at the base of the thumb.
- d) **Epicondylitis** – Painful condition of the elbow caused by muscle damaged due to overuse.
- e) **Digital Neuritis** – Inflammation of the finger nerve causing pain and tenderness.
- f) **Disc Disease** – Disease of the vertebra disc due to overuse which gradually causing slip disc and back pain.
- g) **Hernia** – Occurs when an organ pushes through an opening in the muscle or tissue that hold it in place for example intestine break through a weakened area in the abdominal due to increase negative pressure in the stomach. This usually happen when lifting heavy material.



### Risk Factor

The risk factor includes:

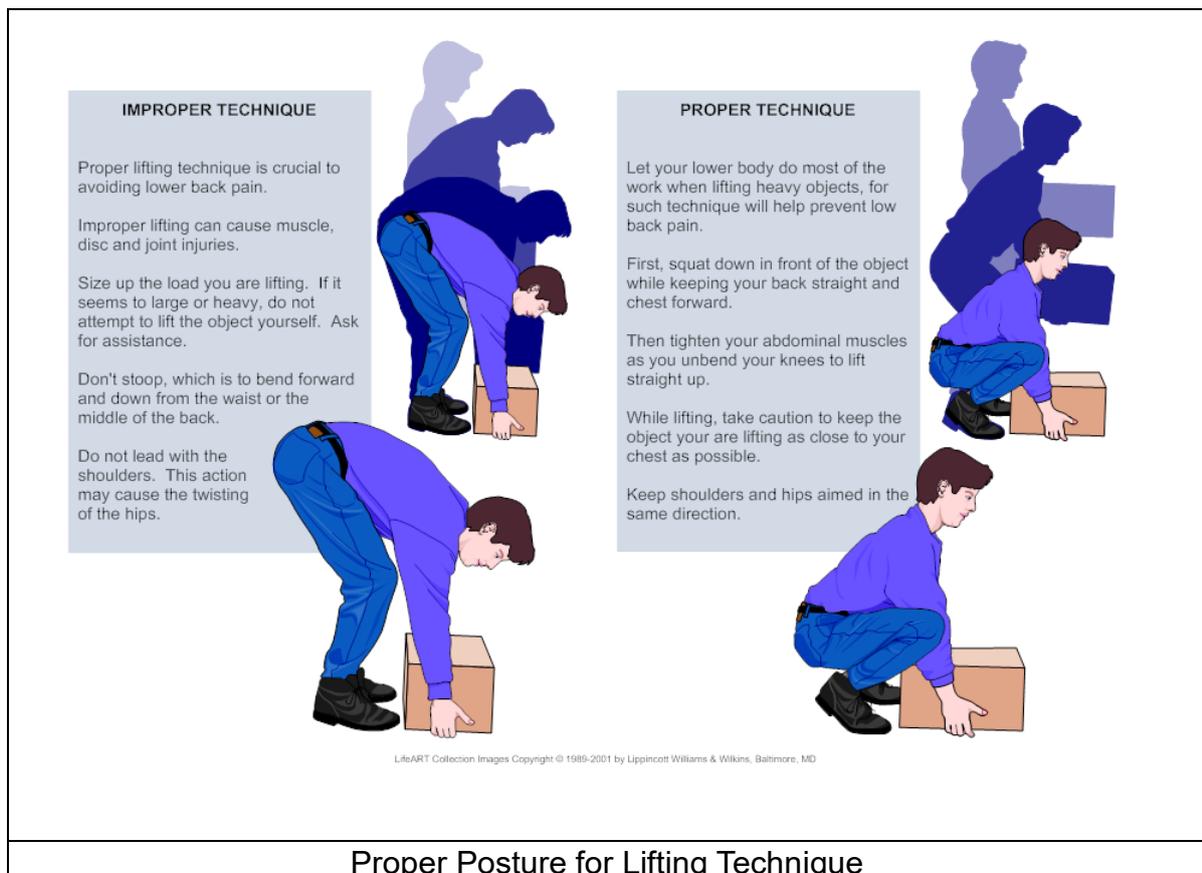
- a) **Exerting excessive force** – Lifting heavy object or people, pushing or pulling heavy load, manually pouring materials or maintaining control of equipment and tools.
- b) **Performing the same task repetitively** – Performing the same motion or series of motions continually or frequently for extended period of time.
- c) **Working in awkward posture or being in the same posture for long periods of time** – Using positions that place stress on the body, such as prolonged or repetitive reaching above shoulder height, kneeling, looking up for a long time, twisting torso while lifting and etc.
- d) **Localized pressure into the body part** – Pressing the body or part of body against hard or sharp edges or using the hand as a hammer.
- e) **Cold temperature** – In combination with any one of the above risk factors may increase potential having MSD.
- f) **Vibration** – Vibration can cause damaged to the small capillaries, nerve ending and blood vessel. Using power hand tools such as drills, hacker and grinder can cause loss of sensory for period of time if prolong exposure.
- g) **Combination of several risk factor.**

## Symptoms

- a) Pain and tenderness.
- b) Loss sensation of the pain, touch, heat or body part.
- c) Visible protruding of an organ.
- d) Numbness and stiffness.
- e) Easily fatigue.
- f) Unable to do a movement.

## Prevention and Control

- a) Identification the type of manual handling risk factor by walkthrough survey, interview and document review.
- b) Implement musculoskeletal discomfort survey questionnaire.
- c) Conduct Initial Manual Handling Risk Assessment by Ergonomic Trained Person which provides recommended weight value for manual handling activities and helps employers to identify high risk manual handling activities.
- d) Implement Manual Handling Risk Management Programme in controlling manual handling related hazards which consist of three elements; leadership elements, organizational elements and operational elements.



## 26.5.2 Poor Hygienic Disease

Construction workers are often at risk from exposure to infectious diseases on construction projects due to poor sanitary conditions associated with toilets and clean-up facilities. Poor sanitation can harbor a lot of bacteria, virus, fungus and parasite that can cause major infectious disease and can be a serious occupational health risk.

### 26.5.2.1 Skin Disease

Skin is the largest organ in the body and act as the first line of defence against infection. Skin infections are caused by a wide variety of germs, and symptoms can vary from mild to serious. Poor hygiene is one of the root causes for an infection of the skin.

#### Type

There are many type of skin infection disease which includes:

- a) **Cellulitis** – A bacterial infection involving the inner layers of the skin.<sup>[1]</sup> It specifically affects the dermis and subcutaneous fat. Cellulitis may first appear as a red, swollen area that feels hot and tender to the touch.
- b) **Furuncle** – Known as boil. Boils are bacterial or fungal infections of hair follicles. The infected hair follicle can be on any part of your body, not only your scalp.
- c) **Warts** – raised bumps on your skin caused by the human papillomavirus (HPV).
- d) **Ringworm** – Also known as dermatophytosis or tinea, is a fungal infection of the skin. The name “ringworm” is a misnomer, since the infection is caused by a fungus, not a worm.
- e) **Athlete’s Foot** – Also known as tinea pedis. It is a contagious fungal infection that affects the skin on the feet. It can also spread to the toenails and the hands. The fungal infection is called athlete’s foot because it’s commonly seen in athletes.
- f) **Onychomycosis** – Also called tinea unguium, is a fungal infection that affects either the fingernails or toenails.
- g) **Scabies** – A skin infestation caused by a mite known as the *Sarcoptes scabiei*. Untreated, these microscopic mites can live on your skin for months. They reproduce on the surface of your skin and then burrow into it and lay eggs. This causes an itchy, red rash to form on the skin.

- h) Lice** - Are small, wingless, blood-sucking insects. They live in the hair on your head and feed off the blood from your scalp. A louse (a single adult) is about the size of a sesame seed. A nit (louse egg) is about the size of a small flake of dandruff.

### **Risk Factor**

The risk factor includes:

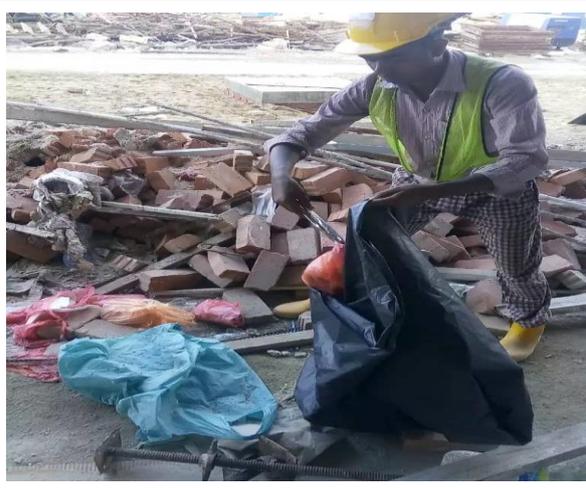
- a) Poor Hygiene** – Poor hygiene such as sharing towel, poor housekeeping and bad sanitation system can cause an infection of the skin.
- b) Working with chemical** – Chemical can kill good bacteria on the skin. Without the good bacteria on the skin, defence mechanism will be reduced lead to infection of the skin.
- c) Diabetes** – Poor blood circulation and elevated blood sugar levels prevent the white blood cells from effectively fighting the infection.
- d) Irritant substance** – Irritant substance such as cement, abrasive hand cleaner, saw dust, solvent, dirt, fibreglass, heat and sweating and etc.
- e) Mechanical trauma** - Recurring rubbing or increased pressure can thicken the inflamed skin with “crazy-paving pattern” (lichenification) and callosity.
- f) Temperature** - Sweat stagnation can cause miliarias, which are small and itchy rashes. Overlapping skin surfaces can become sodden, ending up in intertrigo; which is an infectious inflammation of body folds.

### **Symptoms**

- a) Raised bumps that are red or white.
- b) A rash, which might be painful or itchy.
- c) Scaly or rough skin.
- d) Peeling skin.
- e) Ulcers.
- f) Open sores or lesions.
- g) Dry, cracked skin.
- h) Discoloured patches of skin.

## **Prevention and Control**

- a) Eliminating the use of the hazardous chemical or substituting it with safer alternatives when possible.
- b) Educate workers with the SDS of the chemical they using.
- c) Remind worker to regularly wash their hand after done with the activity
- d) Redesigning work processes to prevent splashes or other contact with harmful materials.
- e) Supervisor to ensure housekeeping must be done before, during and after work is done. Hired general workers for housekeeping.
- f) Schedule at least once a week for general housekeeping to ensure workplace areas are clean.
- g) Employers should supplement them with proper personal protective equipment (PPE). Often this means choosing the right gloves and respirators for the task or chemical involved. **(Refer to Chapter 21 : PPE)**
- h) **Gloves**
  - i. Wear suitable gloves for the job, as some substances can penetrate through gloves
  - ii. Detailed and specific information is available from safety equipment suppliers and is helpful for advising about the right glove to protect against particular substances. Most glove manufacturers have chemical resistance charts, which are supplied free of charge and on their websites
  - iii. Certain nitrile and nitrile butatoluene gloves are also effective against protection from epoxy resin. The Sol-Vex™ glove is effective in protecting hands against epoxy resins, paints and other chemicals is recommended.
  - iv. Wear waterproof gloves for wet work
  - v. Rubber gloves and PVC (polyvinyl chloride) gloves are useful to protect against many other chemicals
  - vi. Powdered latex gloves may contribute to latex allergy in some people with damaged skin. If latex gloves need to be worn, powder-free are preferred
  - vii. If wearing gloves for a long period of time, wear cotton gloves underneath to reduce sweating. You may need to change them half way through the day. Launder them regularly.

	
Ringworm infection	General housekeeping

### 26.5.2.2 Dengue

Dengue is one of the leading issues in Malaysian construction industry. Ministry of Health Malaysia (MOH) classified violation of the breeding issues under **Act 342: Preventive and Control of Infectious Disease Act 1998**. Dengue is a viral infection caused by four types of viruses (DENV-1, DENV-2, DENV-3, DENV-4) belonging to the *Flaviviridae* family.

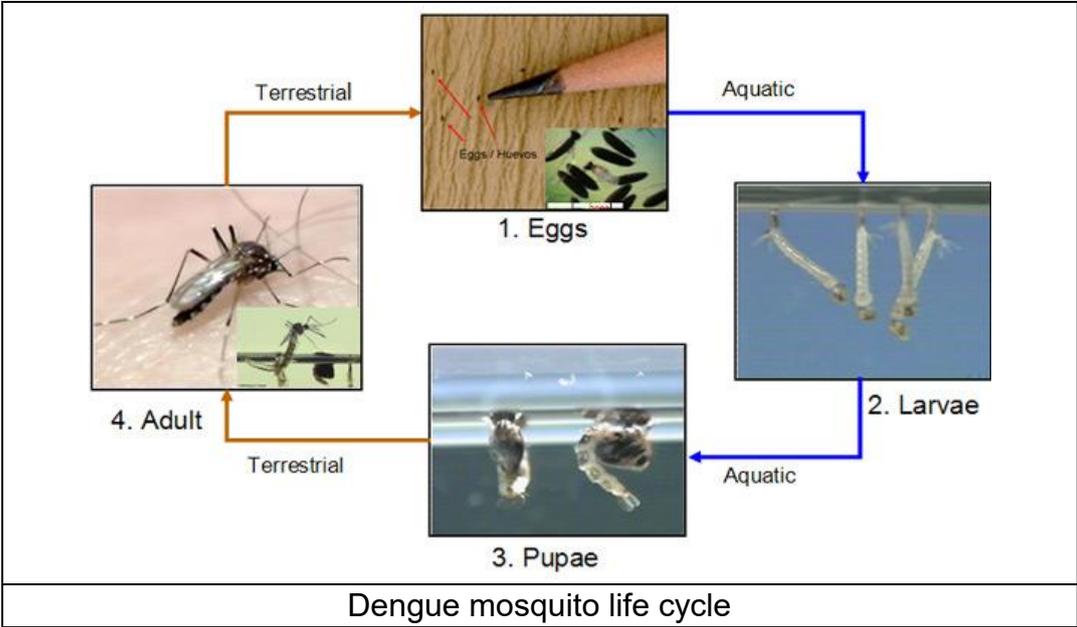
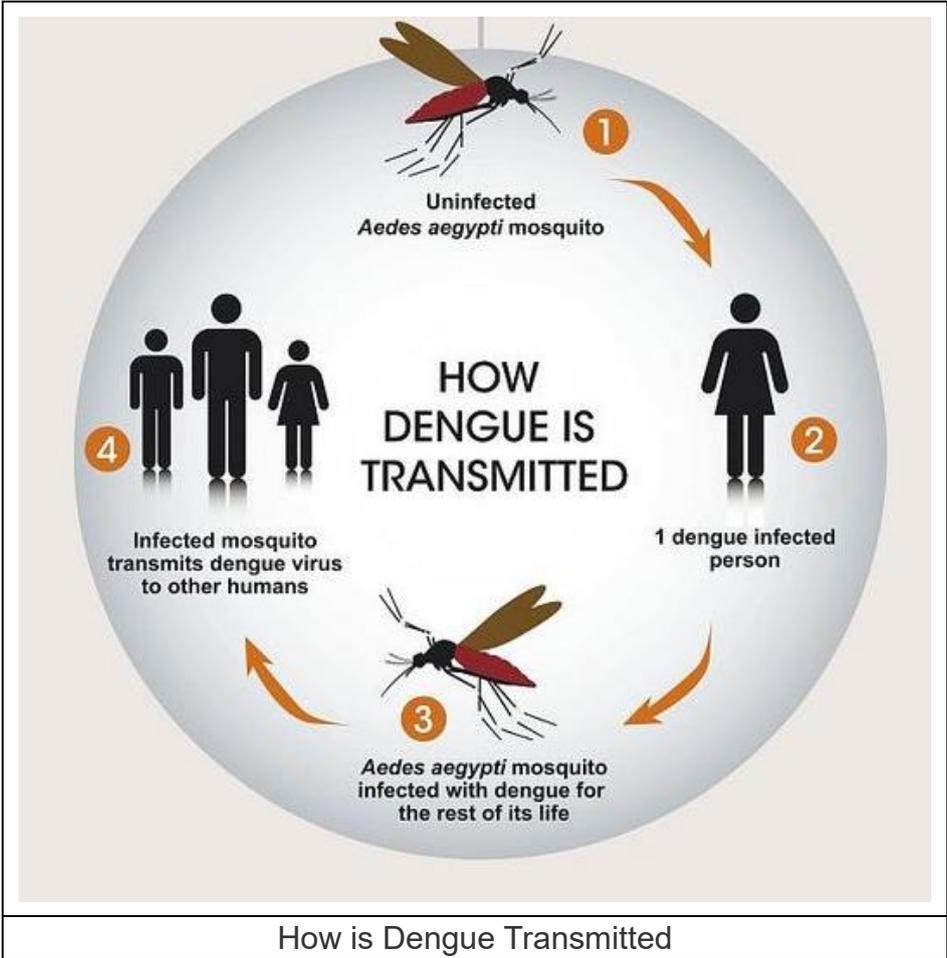
The viruses are transmitted through the bite of infected *Aedes aegypti* and *Aedes albopictus* female mosquitoes that feed both indoors and outdoors during the daytime (from dawn to dusk). These mosquitoes thrive in areas with standing water, including puddles, water tanks, containers and old tires. Lack of reliable sanitation and regular garbage collection also contribute to the spread of the mosquitoes.

## Transmission

- a) The dengue virus is spread through a human-to-mosquito-to-human cycle of transmission. When a dengue mosquito bites someone who is sick with dengue fever, that mosquito is infected and becomes a carrier of the virus. Mosquitoes are capable of spreading the disease within 8-12 days after biting infected person.
- b) The virus will multiply in the salivary glands of the mosquito and then transferred into a healthy human body during mosquito bites. Female mosquitoes infected with dengue virus can also transfer the virus to infect its eggs next newly hatched mosquito.
- c) Once the mosquito is infected by the dengue virus, the mosquito is a carrier of the virus for life and it can spread the virus to other people by biting them. The dengue virus does not spread directly from person to person. Once inside the human body, the virus takes 3-14 days to develop before the symptoms of dengue fever.

## Mosquito Life Cycle

- a) *Aedes aegypti* and other mosquitoes have a complex life-cycle with dramatic changes in shape, function, and habitat.
- b) Female mosquitoes lay their eggs on the inner, wet walls of containers with water.
- c) Larvae hatch (picture 1, inset) when water inundates the eggs as a result of rains or the addition of water by people.
- d) In the following days, the larvae (picture 2) will feed on microorganisms and particulate organic matter, shedding their skins three times to be able to grow from first to fourth instars.
- e) When the larva has acquired enough energy and size and is in the fourth instar, metamorphosis is triggered, changing the larva into a pupa (picture 3).
- f) Pupae do not feed; they just change in form until the body of the adult, flying mosquito is formed.
- g) Then, the newly formed adult emerges from the water after breaking the pupal skin (picture 4, inset).
- h) The entire life cycle lasts 8-10 days at room temperature, depending on the level of feeding. Thus, there is an aquatic phase (larvae, pupae) and a terrestrial phase (eggs, adults) in the *Ae. aegypti* life-cycle.



## Symptoms

In some cases, Dengue infection is asymptomatic – persons do not exhibit symptoms. Those with symptoms get ill between 4 to 7 days after the bite.

- a) Flu-like symptoms which include a sudden high fever coming in separate waves.
- b) Pain behind the eyes
- c) Muscle and joints pain
- d) Severe headache
- e) Skin rash with the red spot

The illness may progress to Dengue Hemorrhagic Fever (DHF). The symptoms like:

- a) Severe abdominal pain.
- b) Vomiting
- c) Diarrhoea
- d) Convulsion
- e) Bruising and uncontrolled bleeding
- f) High fever that last from 2 – 7 days
- g) Complication may lead to circulatory system failure and shock leading to death.

## Common area for breeding

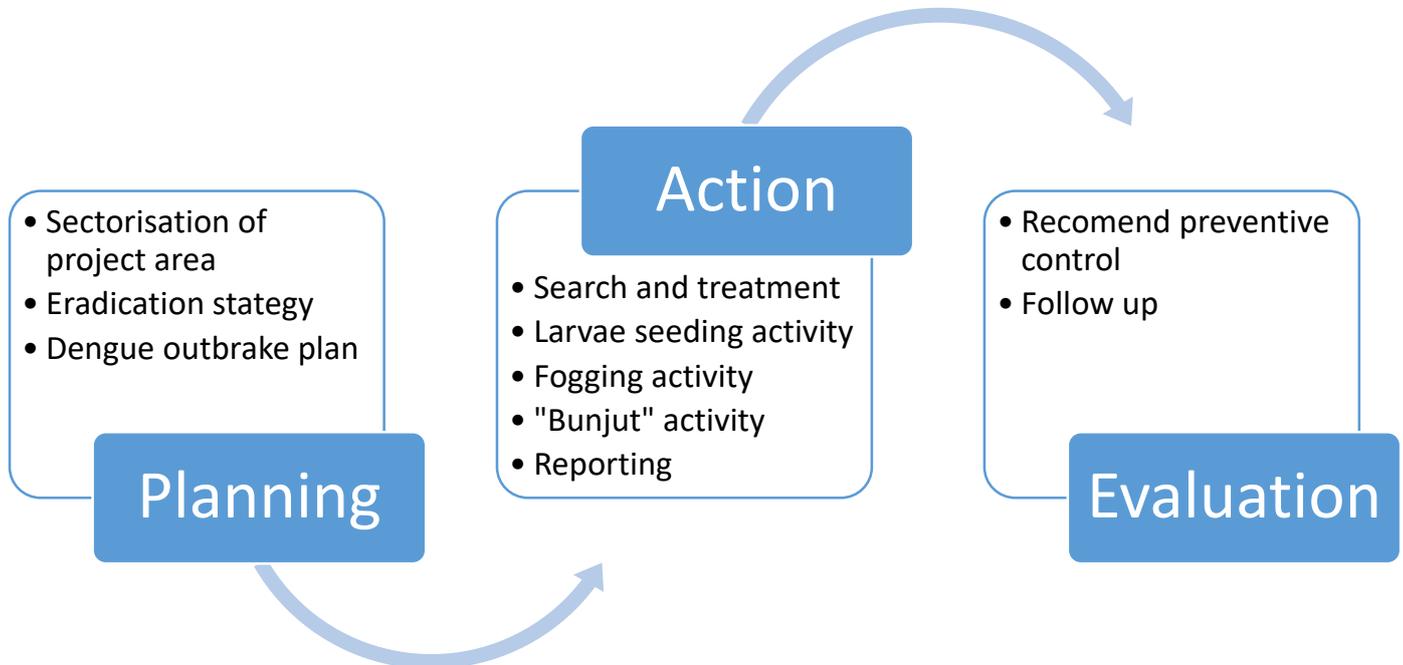
- a) Canvas sheet or plastic sheet
- b) Water puddle, ground depression and water stagnant
- c) Container and tyre
- d) Receptacles
- e) Hollow metal rod or aluminium formwork.



Canvas sheets breeding area	Water ponding breeding area
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## Prevention and control

### a) Vector control strategy



- b) Eradication planning by environmental manipulation such as :
- Filling up or levelling the ground depression or concrete-pave bare earth.
  - Construct and maintain concrete drains to channel away water
  - Pitch roof for container office
- c) Regular housekeeping team to control the rubbish which following schedule and checklist.
- d) Hired outsource pest control to help with the control of the mosquito breeding.
- e) Using chemical or poison that recommended by Ministry Of Health.
- f) Schedules fogging, larvae seeding and "bunjut" activity. (**Refer to appendix 3 for chemical used and explanation**).
- g) Increase awareness of the worker regarding **Dengue Fever** through campaign, training and toolbox briefing.
- h) Provide workers with a repellent containing 20%-30% DEET or 20% Picaridin on exposed skin. Re-apply according to manufacturer's directions.
- i) Advice workers to wear neutral-coloured (beige, light grey) clothing. If possible, wear long-sleeved, breathable garments.

**APPENDIX 1 FIRST AID BOX CHECKLIST**

## First Aid Box Checklist

EHS-05

Location :		Date:	
Inspected by:		Designation:	
S/No.	Items	Required content	Remarks
1.	Small sterilized dressings	12	
2.	Medium sterilized dressings	6	
3.	Large sterilized dressings	6	
4.	Adhesive wound dressings	24	
5.	Triangular bandages	4	
6.	1 inch roller bandages	9	
7.	2 inch roller bandages	9	
8.	Adhesive plaster	Sufficient supply	
9.	Absorbent sterilized cotton wool packets	6	
10.	Cotton wool strip contained in cotton wool dispenser	Sufficient supply	
11.	Splints and wool for padding	Sufficient supply	
12.	Eye ointment or eye drops	Sufficient supply	
13.	Sterilized eye pads	4	
14.	Pressure bandage	1	
15.	Iodine	1	
16.	Gentian violet	1	
17.	Salt volatile	1	
18.	Scissor	1	
19.	Safety pins	24	



## **DEPARTMENT OF OCCUPATIONAL SAFETY AND HEALTH MINISTRY OF HUMAN RESOURCES**

This book is developed based on conjunction between the Department of Occupational Safety and Health Malaysia with Giant Leap Construction Sdn. Bhd.

The purpose is for sharing of experience and knowledge between China Construction Company practice in Occupational Safety, Health & Environment in line with Malaysia Laws & Regulations.

Reducing incident rate in construction industries has always been a challenge for construction company. This book of best practices serve as a guide for contractors in minimizing incident rate in occupational safety, health and environment. This book of best practices cover 90% of construction activities which covers from the beginning of projects until its completion.

ISBN 978-967-16706-2-0



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