Participant Handbook

Sector
Construction Skill Development Council of India

Sub-Sector
Real Estate and Infrastructure Construction

Occupation
Scaffolding

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NSQF Level 3

Assistant Scaffolder - System

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Shri Narendra Modi
Prime Minister of India

Certificate

COMPLIANCE TO

QUALIFICATION PACK- NATIONAL OCCUPATIONAL STANDARDS

is hearby issued by the

CONSTRUCTION SKILL DEVELOPMENT COUNCIL OF INDIA

for

SKILLING CONTENT:PARTICIPANT HANDBOOK

Complying to National Occupational Standards of

Job Role/Qualification Pack:'Assistant Scaffolder - System'

QP No.'CON/Q0314, Version 3.0 NSQF Level 3'

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Authorised Signatory
(Construction Skill Development Council)

Acknowledgements

This participant's handbook meant for Assistant Scaffolder System is a sincere attempt to ensure the availability of all the relevant information to the existing and prospective job holders in this job role. We have compiled the content with inputs from the relevant Subject Matter Experts (SMEs) and industry members to ensure it is the latest and authentic. We express our sincere gratitude to all the SMEs and industry members who have made invaluable contributions to the completion of this participant's handbook.

This handbook will help deliver skill-based training in the Assistant Scaffolder – System field. We hope that it will benefit all the stakeholders, such as participants, trainers, and evaluators. We have made all efforts to ensure the publication meets the current quality standards for the successful delivery of QP/NOS-based training programs. We welcome and appreciate any suggestions for future improvements to this handbook.

About this book

This participant handbook has been designed to serve as a guide for participants who aim to obtain the required knowledge and skills to undertake various activities in the role of an Assistant Scaffolder - System. Its content has been aligned with the latest Qualification Pack (QP) prepared for the job role. With a qualified trainer's guidance, the participants will be equipped with the following for working efficiently in the job role:

- Knowledge and Understanding: The relevant operational knowledge and understanding to perform the required tasks.
- Performance Criteria: The essential skills through hands-on training to perform the required operations to the applicable quality standards.
- Professional Skills: The Ability to make appropriate operational decisions about the field of work.

The handbook details the relevant activities to be carried out by an Assistant Scaffolder- System. After studying this handbook, job holders will be adequately skilled in carrying out their duties according to the applicable quality standards. The handbook is aligned with the following National Occupational Standards (NOS) detailed in the latest and approved version of Assistant Scaffolder- System QP:

- CON/N0354: Assist in erection and dismantling of scaffold using pipe and coupler
- CON/N0355: Assist in erection and dismantling of common customized system scaffold
- CON/N8001: Work effectively in a team to deliver desired results at the workplace
- CON/N9001: Work according to personal health, safety and environment protocol at construction site
- DGT/VSQ/ N0101: Employability Skills

The handbook has been divided into an appropriate number of units and sub-units based on the content of the relevant QP. We hope it will facilitate easy and structured learning for the participants, allowing them to obtain enhanced knowledge and skills.

Symbols Used


Key Learning Outcomes


Exercise


Notes


Unit Objectives


Activity

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It is recommended that all trainings include the appropriate Employability skills Module. Content for the same can be accessed https://www.skillindiadigital.gov.in/content/list

1. Introduction to Scaffolding Occupation

Unit 1.1 – Introduction to Scaffolding
Unit 1.2 – Role and Responsibilities of an Assistant Scaffolder-System

Key Learning Outcomes

By the end of this module, participants will be able to:

- Describe the function and duties of an assistant scaffolder system
- Apply fundamental unit, measurement, and arithmetic knowledge and skills.
- Recall the fundamental terms used in the scaffolding industry
- Discuss potential future progressions and career options for a system assistant scaffolder

Unit 1.1 Introduction to Scaffolding

Unit Objectives

By the end of this unit, participants will be able to:

- Give an overview of the construction industry.
- Recall the basic terms used in scaffolding occupation.
- Apply the basic knowledge of units, measurement and arithmetic calculation.

1.1.1. Construction Industry

The construction industry is the oldest and one of the largest in the world, with a market size of over 10 trillion dollars. Construction has traditionally been a contracting sector, and the industry consists of a huge number of small businesses. Currently, the building industry is one of the main economic sectors. It contributes significantly to the national economy and employs a substantial number of people.

Construction Industry in India

During the forecast period, India's construction market is expected to grow at a CAGR greater than 10%. (2022–2027). As COVID-19 spread over the country in April 2020, the Indian construction sector, which was already struggling with poor management and a lack of labour force tracking, totally lost its central grip, bringing an end to the business. COVID-19 caused havoc on all levels and scales of the value chain.

- The availability of building supplies and the rate of price rise were major concerns. The lack of timely implementation due to lockdowns led to cost overruns, significant delays, and even the cancellation of projects.
- Many MSMEs were compelled to close their doors or restrict their activities as a direct result of the cancellation and postponement of projects. This was a major concern because the majority of construction firms and design studios are small and specialize in a certain style of structure.
- Despite the impact of COVID-19 restrictions and lockdowns on construction activity, India experienced 45 million square feet of new supply in 2020, with 36 million square feet coming from tier I cities and 8.9 million square feet from tier II and III cities.
- The 3PL and e-commerce sectors, which accounted for 62 percent of total absorption in 2020, continued to drive warehouse demand in 2021, with the manufacturing sector accounting for 14 percent. Delhi-NCR had the highest absorption rate among India's major cities in 2021, at 18%, followed by Pune at 15%. 14 percent and 11 percent absorption rates were recorded in Mumbai and Bangalore, respectively, with 20 percent in tier II and tier III cities.
- In 2021, industrial and logistics sector investments surpassed USD 1.5 billion, making it the second-largest receiver of such money after the office sector. This asset category has maintained its popularity due to its strong growth rate and regular returns.

The commercial real estate subsector is poised for growth as individuals return to the workplace and organizations adopt hybrid work arrangements. As more companies send their employees back to work, the demand for commercial office space gradually increases.

1.1.2. Types of Construction

The following are the types of construction:

a. Building construction:

Building construction is the act of adding a structure to undeveloped ground and adapting it for various uses, including residences, commercial buildings, garages, etc. The bulk of building construction projects involve minor improvements, such as adding a room, renovating a bathroom, enhancing a porch, etc.

There are differences between building construction projects, but there are some aspects and procedures that are universal. For example: design considerations, a budgetary estimate, and ethical and legal factors.

In the case of commercial building construction, multiple strategies are utilised. They consist of Design & Build, Cost Estimating, Competitive Bidding, Contract Management, Construction Management, and Design-Build Bridging.

The governments of all states and nations have enacted laws and regulations governing the construction of both commercial and residential buildings. During the designing and building processes, these norms and regulations must be properly adhered to. The materials required for the construction process should be readily accessible at the construction site. Brick construction is the most common technique of house construction in India.

b. Industrial Construction:

Industrial construction represents a minor portion of the construction sector. Even so, it is regarded as quite vital. Planning the layout of an industry, establishing industrial sectors, installing heavy machinery, and planning and constructing the size of an industry are the procedures involved in industrial construction.

Infrastructure, power transmission and distribution, metallurgy and material handling, medicine, petroleum, chemical, power generation, manufacturing, etc. are the primary aspects to be considered.

This form of building requires extremely specific knowledge of planning, cost estimation, design, and construction. When a large construction business launches a project, it typically assigns the task of ensuring the project's success and safety to a team. Architects and civil engineers are employed to assist in the planning of construction projects. In this instance, construction entails the construction or assembly of infrastructure.

Large-scale building projects necessitate the completion of several jobs by a large number of individuals. Different jobs are provided to different teams. For instance, a Project Manager is responsible for Project management,

Fig. 1.1.1 Industrial Construction Site Plan

while a Construction Manager oversees Project construction. Additional examples include Design engineer, Project architect, and Financial Advisor. If a project is to be conducted successfully, the following must be ensured: Effective planning, successful scheduling, budgeting, construction site safety, availability of building materials, and logistics are essential for a successful construction project (that is transport of raw materials, etc).

c. Infrastructure Construction

Infrastructure, often known as heavy civil or heavy engineering, consists of massive public works, dams, bridges, highways, railroads, water or wastewater systems, and utility distribution. Civil engineering encompasses the design, building, and maintenance of the physical and naturally built environment, such as roads, bridges, canals, dams, tunnels, airports, water and sewage systems, pipelines, and railways.

Fig. 1.1.2 Under Construction Bridge

The infrastructure sector is an important economic driver in India. The sector is largely responsible for driving India's overall growth, and the government has placed a great deal of emphasis on implementing laws that will expedite the establishment of world-class infrastructure in the country. The infrastructure sector consists of power, bridges, dams, highways, and the development of urban infrastructure. In other words, the infrastructure sector functions as a catalyst for India's economic growth by driving the expansion of associated industries such as townships, housing, built-up infrastructure, and construction development projects.

1.1.3. Market Segment of Construction Industry

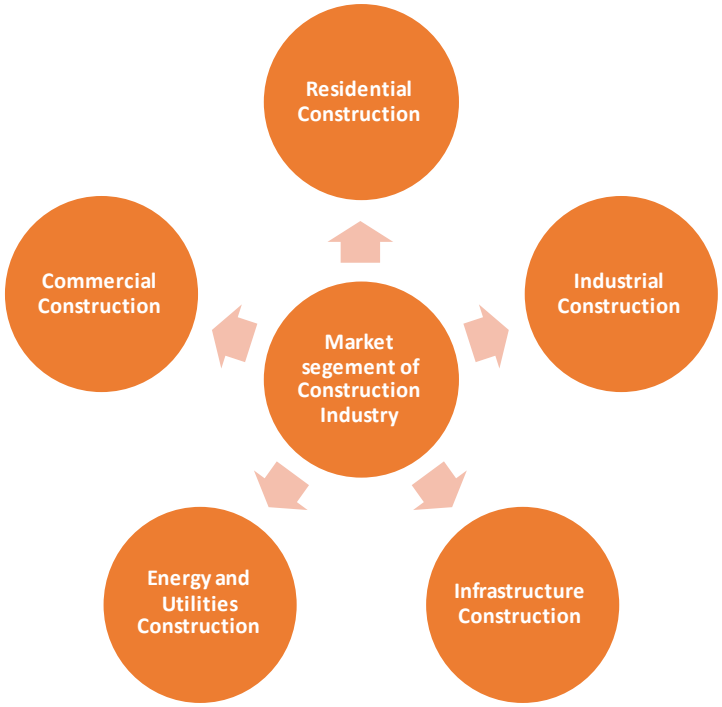

Fig. 1.1.3 Market segment of construction industry

1.1.4. Scaffolding

Scaffolding is a temporary structure used to support construction workers, labours, cleaners, inspectors, and others who have to work at height. It is also called staging. The main purpose of constructing a scaffold is to build a platform that allows workers to operate at various heights. Scaffolds also assist in lifting materials for various heights of immediate usage. Metal poles made of aluminium and steel as well as hardwood planks can be used to construct it.

Fig. 1.1.4 Scaffolding at a construction site

Benefits of Scaffolding

Scaffolding is one of the most important component of construction. The primary advantages of scaffolding are:

- **Access.** Scaffolding can provide unobstructed, stable access to virtually any region of a structure.
- **Balance.** Scaffolds provide workers with stable footing, allowing them to maintain balance in a variety of operating situations.
- **Construction ease.** Scaffolding is generally simple to assemble and remove, and may be erected and dismantled quickly.
- Long-lasting. Whether they're composed of wood or steel, most scaffolding may last for an extremely long time.
- **Safety.** Safety is one of the most essential benefits of scaffolding, as it provides a stable working platform for personnel. The best option for work at height, however, is to reduce or even eliminate the requirement for a person to be there; in the final portion of this guide, we will discuss how drones can assist inspectors lessen their need to work at height.
- **Functions as a bridge.** A variety of construction tasks necessitate that workers take circuitous paths to reach specific areas, which is a major time waster. By shortening the distance that employees must go, bridging points on scaffolding can aid in solving this issue.

1.1.5. Uses of Scaffold

Nowadays, scaffolding is utilized for a variety of purposes. Here are some of the most prevalent applications for scaffolding:

- **Cleaning:** Workers frequently use scaffolding to clean windows and other components of tall structures.
- **Construction:** Scaffolding is essential for construction because it allows employees to stand on a secure surface at heights. This is notably true for skyscrapers and other high-rise structures, but it is also a typical practise for ground-level construction projects.
- **Occupational inspections:** Scaffolding is commonly used for inspections because it enables inspectors to reach inaccessible regions to conduct visual inspections and other NDT testing. Inspectors frequently employ internal scaffolding or other temporary structures for both internal and external inspections, such as those performed inside enormous industrial boilers or pressure vessels. Regardless of the type of inspection, the scaffolding serves the same purpose: to enable inspectors to stand at height and conduct a variety of tests to satisfy inspection criteria.

- **Maintenance:** Typically, inspections are the initial stage in a maintenance procedure, as they identify areas that may require maintenance. After these faults are discovered by inspectors, maintenance personnel will address them while standing on scaffolding.
- **Other uses:** Different types of scaffolding are also employed for:
  - Theatrical stages
  - Installations of art
  - Exhibition displays
  - Observation platforms
  - Observation stand seating
  - Shoring Ski ramps

1.1.6. Scaffolding Terms

1. **Decking:** Decking refers to the horizontal platforms that provide support for employees while they are on a scaffold. At heights exceeding 2 metres, working platforms should be nearly completely boarded to lessen the risk of falling. Moreover, the breadth of these platforms needs to be appropriate for the work being done.

2. **Guardrails:** When standing, these railings are positioned at mid-height. Any scaffolds over 2 metres where there is a risk of falling must have them. Between 91cm and 115cm above the working platform, guardrails should be placed. If the guardrail is taller than 91.5 cm, there should be a second guardrail or a higher toe board such that the distance between them is no greater than 76.5 cm. Guardrails may be removed for necessary work purposes, but they must be replaced as soon as it is practical.

3. **Ledgers:** Ledgers are horizontal tubes that attach to the scaffold's standards along its length. These tubes, also referred to as "runners," provide additional support and aid in weight distribution. With load-bearing couplers, ledgers should be fastened to the interior of standards.

4. **Facade Bracing:** Longitudinal or Facade Bracing is the use of a tube of bracing that is fastened at 35° and 55° to help avoid sway. Every lift level, including the base, should have fixed facade bracing.

5. **Putlogs and Transoms:** Putlogs and Transoms are securely fastened to ledgers or standards that span the width of the bay from back to front. Using right-angled or putlog couplers, transoms or putlogs are secured.

6. **Scaffold Boards:** The various boards that make up a scaffold platform are known as Scaffold Boards. These boards may extend beyond a putlog or transform, but not by more than 50 cm. The thickness of the board can also affect how much it can overhang.

7. **Standards:** The lengthy pipes that run vertically and sustain the scaffold's weight down to the ground. To help spread the weight, standards are fastened to foundation plates and sole boards at the bottom.

8. **Ties:** Ties are used to secure the scaffold to the building or structure, which increases stability and reduces inward and outward movement.

9. **Toe Boards:** These boards run down the bottom beneath the midrail and guardrail, preventing tools, supplies, and other objects from falling off the edge of the scaffold.

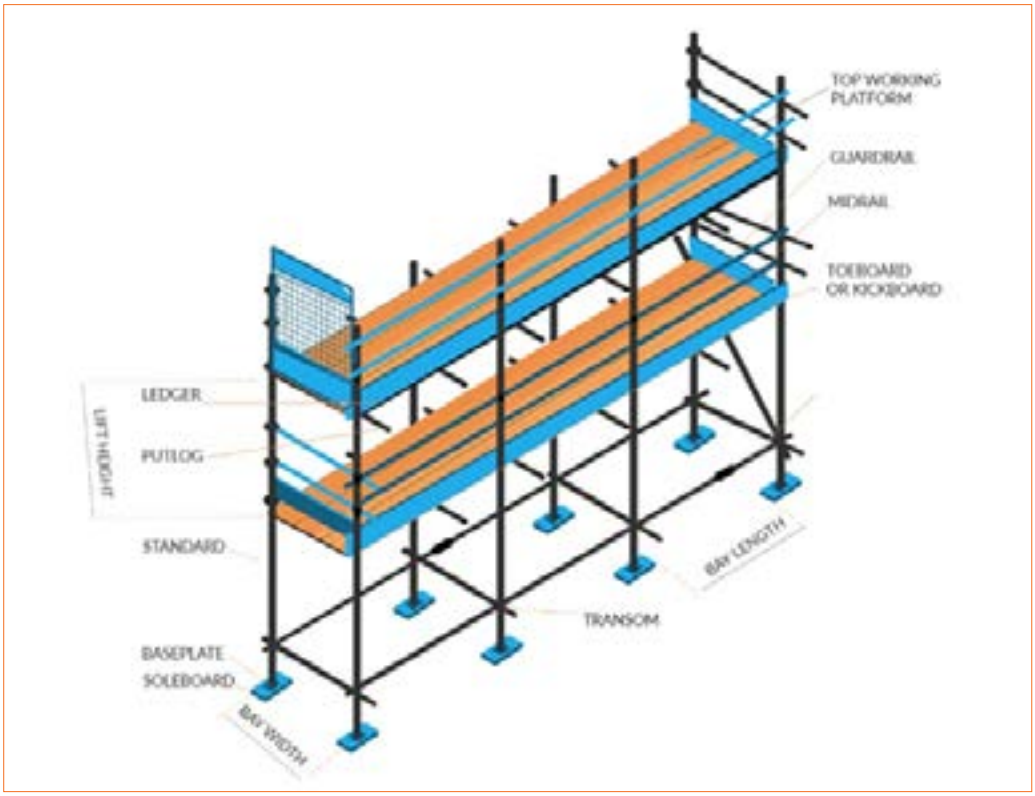

Fig. 1.1.5 Scaffolding Structure

1.1.7. Important units, measurement and arithmetic calculation

Measurements: The importance of measurements and calculation in scaffolding cannot be understated. Accurate measurements are critical in scaffolding safety and work performance. Proper measurements result in a stable scaffolding structure that is strong enough to support the load, but not overbuilt, which can lead to unnecessary costs and inefficiency. It is important to take precise measurements of the structure, materials, tools, and any other factors that can affect the success of scaffolding.

In addition to safety, precise measurements are key for efficiency. When making measurements for scaffolding, the importance lies in accuracy. A mistake in any measurement can cause the structure to be over or underbuilt, leading to additional costs and wasted time. Working with precise measurements ensures that the scaffolding is built to the right size and materials, saving both time and money.

Scaffolding is typically measured in metric dimensions with the main factors being height, width, and length.

- **Height:** Height of the scaffolding is traditionally measured in meters, with most scaffolding ranging from 1-3 meters in height.
- **Width:** The width of the scaffolding is also traditionally measured in meters, with most scaffolding ranging from 1-2 meters in width.
- **Length:** The length of the scaffolding is typically measured in linear meters, with the most common length being 4-6 meters.

Other measurements include weight, surface area, and space between the scaffolding and any other structures. The weight of the scaffolding can be measured in kilograms, with the surface area and space being measured in square meters.

Unit conversions: Unit conversions for scaffolding are an important part of construction work. As scaffolding is often used to assist in the construction of high-rise buildings, measurements must be precise, as even the slightest error can cause significant safety issues.

To facilitate precise measurements and unit conversions, scaffolding professionals must use a dedicated metric system. The metric system is the most commonly used system for measurements, and it allows for precise conversion between different units of measurement.

For example, a metric system allows for the conversion of meters to centimetres, or centimetres to millimetres. This system also allows for the conversion of bigger units, such as one foot to 12 inches or one yard to three feet.

In addition to unit conversions, scaffolding professionals must also be knowledgeable in the different types and sizes of scaffolding that are available. This is because the type and size of scaffolding can affect the stability, strength, and height of a structure. Different materials, components, and designs can also have an impact on the stability and structural integrity of a scaffolding system.

Arithmetic calculations: Arithmetic calculations are used in this process to ensure that the scaffolding is correctly designed and built to support the weight of the structure and building materials. For example, calculations involving load-bearing capacity, the distance between supports, and other structural requirements must be done to ensure that the scaffolding is safe and secure. Additionally, calculations for materials such as lumber, steel, and concrete must be performed to determine the number of materials needed to construct the scaffolding. Calculations for labor costs, rental fees, and other expenses must also be done. Overall, arithmetic calculations are essential for the successful planning and construction of scaffolding.

Here are the basic arithmetic calculations involved in scaffolding:

1. **Calculating the overall height of the scaffolding structure:** The overall height of the scaffolding structure can be calculated by adding the height of the scaffold platform, the height of the support frame, the height of the braces, and the height of any additional frame elements such as ladders or guard rails.

2. **Determining the number of horizontal supports needed:** To determine the number of horizontal supports for a given scaffolding structure, first calculate the total length of the structure, then divide that total length by the distance between supports given in the manufacturer's instructions.

3. **Calculating the load bearing of the scaffolding:** To calculate the load bearing of the scaffolding, first calculate the total weight of the load that will be placed on the scaffold. Then, using the manufacturer's instructions, divide the total load weight by the number of support points to calculate the amount of weight each supporting point will bear.

4. **Calculating the wind load on the scaffolding:** To calculate the wind load on the scaffolding, first determine the wind speed in the area where the scaffolding will be erected. Then, using the manufacturer's instructions, calculate the wind load by multiplying the wind speed by the area of the scaffolding.

5. **Calculating the total area of the scaffolding:** To calculate the total area of the scaffolding, first measure the length and width of the scaffolding to determine the area of the base. Then, measure the height and width of any additional frame elements, such as ladders or guard rails, and add that area to the total.

Notes

Scan the QR code to watch the video

https://youtu.be/nndLyZrGfWc

Construction Industry

https://youtu.be/1WVzo2UFyo8

Types of Construction

https://youtu.be/96shGh3rfXw

Scaffolding

https://youtu.be/5Vj-MosphpY

Uses of Scaffold

https://youtu.be/TAGDIgRYcsc

Scaffolding Terms

Unit 1.2 Role and Responsibilities of an Assistant Scaffolder-System

Unit Objectives

By the end of this unit, participants will be able to:

- Describe the role and responsibilities of an assistant scaffolder system
- Discuss future possible progression and career options for an assistant scaffolder system

1.2.1. Assistant Scaffolder - System

The Assistant Scaffolder-System is responsible for assisting with the erection, dismantling, and maintenance of various types of customised system scaffolds under instructions and careful supervision. The person should be well-versed in safe working methods and techniques when working at heights.

An assistant scaffolder- system is expected to be knowledgeable about:

- Tools, materials, and accessories used in the erection and dismantling of scaffolds
- Unit conversion and measurement
- Standard processes and principles involved in scaffold erection and dismantling
- Required safety standards and operating methods for scaffolding work.

1.2.2. Role and Responsibilities of an Assistant Scaffolder - System

An assistant scaffolder- system completes tasks associated with scaffolding work that are similar in terms of the methods, tools used, and comfortable working environments. The primary responsibility of the position is to carry out smaller tasks to support the construction scaffolder in a variety of activities. The roles and responsibilities of an assistant scaffolder- system are:

- Assisting in the erection of a scaffold
- Selecting, shifting and stacking materials and components at workplace
- Handle all required tools, tackles, materials & equipment safely
- Performing markings and measurements
- Assisting in dismantling of scaffold
- Following standard safety procedures and housekeeping practices
- Identifying and reporting any hazards, risks or breaches in site safety

1.2.3. Personal Attributes required by an Assistant Scaffolder–System

An Assistant Scaffolder–System should be:

- Physically fit, mentally alert, and safety-minded
- Able to work in different places with different weather and site conditions
- Able to work well as part of a team
- Good in verbal and written communication
- Able to use different tools, materials, and components for scaffolding
- Able to work under continuous instruction and close supervision.

1.2.4. Career Progression of an Assistant Scaffolder – System

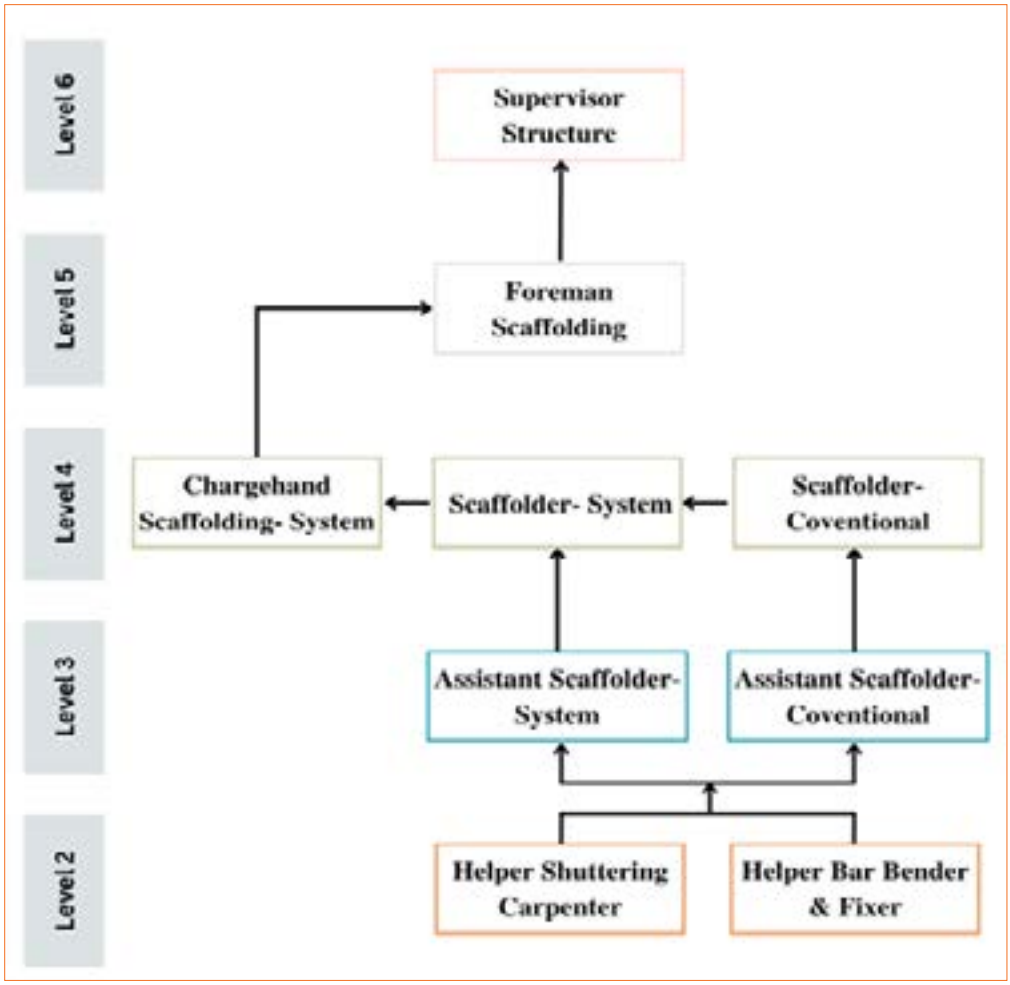

Fig. 1.2.1 Career Progression of an Assistant Scaffolder- System

Exercise

1. What is Scaffolding? Explain its importance.
2. Show the career path of an Assistant Scaffolder- System.
3. What are role and responsibilities of an Assistant Scaffolder- System?
4. State few personal attributes required by Assistant Scaffolder- System.
5. List the basic arithmetic calculations involved in scaffolding.

Notes

Scan the QR code to watch the video

https://youtu.be/veF4uSUtrEY

Role and Responsibilities of an Assistant Scaffolder - System

2. Erection and Dismantling of Scaffold Using Pipe and Coupler

Unit 2.1 - Erection and Dismantling of Scaffold Using Pipe and Coupler

(CON/N0354)

Key Learning Outcomes

By the end of this module, participants will be able to:

- List the various materials, tools and equipment used in pipe and coupler scaffolding along with their standard sizes
- Explain the applications various materials, tools and equipment used in pipe and coupler scaffolding
- Explain the process of stacking and storing materials used in pipe and coupler scaffolding work
- Explain application of slings, shackles, and belts for lifting and shifting of scaffold materials
- Use different measuring, marking and leveling tools for scaffold erection works
- Explain common defects in pipes and couplers
- Identify the common defects in pipes and couplers
- Describe criteria for selection of pipes, swivel coupler, right angle coupler etc. based upon types of work
- Describe the sequence and standard procedure for erection of scaffold using pipes and couplers
- Describe importance of providing supports to scaffold
- Demonstrate preparation of base for pipe and coupler scaffolding work
- Describe the measures taken for protection of work and work area
- Discuss standard procedure for erection and dismantle of pipe and coupler scaffold
- Summarize knowledge about upkeep, repair and maintenance of tools
- Demonstrate the preparatory works for scaffold erection including marking and transferring of levels.
- Demonstrate the erection of pipe and coupler scaffold in single and double staging up to the specified height
- Demonstrate checks for alignment as per instruction
- Demonstrate the process of providing support in a pipe and coupler scaffolding works
- Demonstrate the dismantling of pipe and coupler scaffold in single and double staging up to the specified height

Unit 2.1 Erection and Dismantling of Scaffold Using Pipe and Coupler

Unit Objectives

By the end of this unit, participants will be able to:

- List the various materials, tools and equipment used in pipe and coupler scaffolding along with their standard sizes
- Explain the applications various materials, tools and equipment used in pipe and coupler scaffolding
- Explain the process of stacking and storing materials used in pipe and coupler scaffolding work
- Explain application of slings, shackles, and belts for lifting and shifting of scaffold materials
- Use different measuring, marking and leveling tools for scaffold erection works
- Explain common defects in pipes and couplers
- Identify the common defects in pipes and couplers
- Describe criteria for selection of pipes, swivel coupler, right angle coupler etc. based upon types of work
- Describe the sequence and standard procedure for erection of scaffold using pipes and couplers
- Describe importance of providing supports to scaffold
- Demonstrate preparation of base for pipe and coupler scaffolding work
- Describe the measures taken for protection of work and work area
- Discuss standard procedure for erection and dismantle of pipe and coupler scaffold
- Summarize knowledge about upkeep, repair and maintenance of tools
- Demonstrate the preparatory works for scaffold erection including marking and transferring of levels.
- Demonstrate the erection of pipe and coupler scaffold in single and double staging up to the specified height
- Demonstrate checks for alignment as per instruction
- Demonstrate the process of providing support in a pipe and coupler scaffolding works
- Demonstrate the dismantling of pipe and coupler scaffold in single and double staging up to the specified height

2.1.1. Pipes and Couplers Scaffolding

Pipes (Tube) and couplers scaffolding is a common type of scaffolding used in the construction industry. It is a modular system that uses steel tubes and couplers to create a stable and safe platform for workers to access and work at height. The system consists of steel tubes of various lengths and diameters that are connected by couplers to form the scaffold structure.

The couplers used in the system are of various types, including swivel couplers, right angle couplers, sleeve couplers, putlog couplers, girder couplers, and gravlock couplers. The type of coupler used will depend on the specific requirements of the job and the configuration of the scaffolding structure.

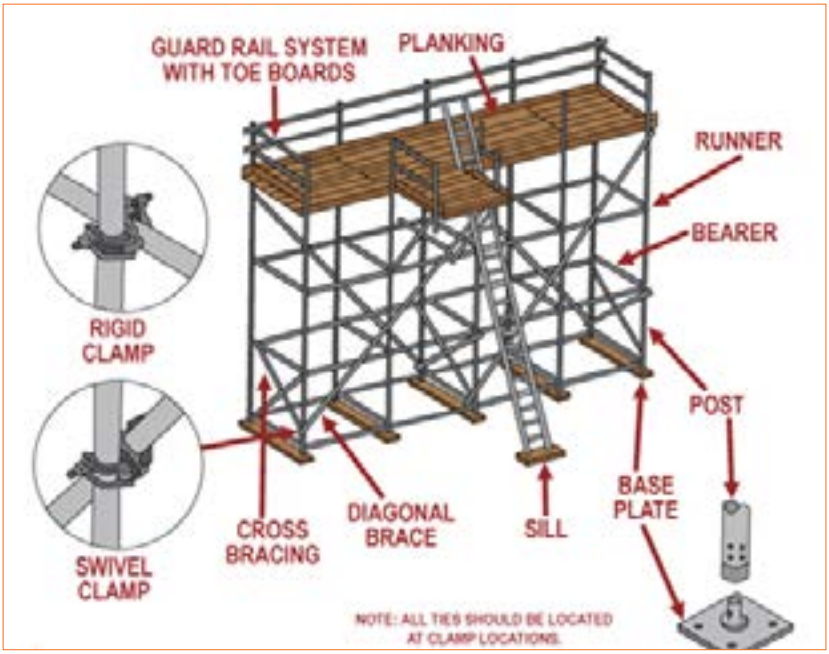

Fig. 2.1.1 Pipes and Couplers Scaffolding
(Source: https://www.oshatrain.org/courses/mods/804m3.html)

The pipes and couplers scaffolding system is highly adaptable and can be used for a range of applications, including external building work, maintenance, and repair work. It is also commonly used for temporary structures, such as staging for events or outdoor performances.

The advantages of using pipes and couplers scaffolding include its versatility, durability, and ease of assembly. The system is also highly customizable, allowing for modifications to be made to suit specific requirements of the job.

However, there are some limitations to this system. The assembly of pipes and couplers scaffolding can be time-consuming and requires skilled labor. Additionally, the weight of the scaffolding structure can be heavy, making it difficult to move or dismantle.

Overall, pipes and couplers scaffolding is a popular and reliable option for a wide range of construction and maintenance projects, providing a safe and stable platform for workers to carry out their tasks at height.

2.1.2. Types of Couplers used in Scaffolding

Couplers	Description	Images
Swivel Coupler	Swivel couplers are used to connect two scaffold tubes at any angle, providing greater flexibility in the construction of scaffolding structures. They consist of a bolt, a nut, and a swiveling clamp that can be tightened or loosened to connect two tubes.	
Right Angle Coupler	Right angle couplers are used to connect two scaffold tubes at a right angle. They consist of a bolt, a nut, and two clamps that are fixed at a 90-degree angle.	
Sleeve Coupler	Sleeve couplers are used to connect two scaffold tubes end-to-end. They consist of a tube with two internal clamps that are tightened with a bolt and nut.	
Putlog Coupler	Putlog couplers are used to connect a scaffold tube to a brickwork or concrete structure. They consist of a fixed clamp and a swiveling clamp that can be adjusted to fit the tube and the structure.	
Girder Coupler	Girder couplers are used to connect a scaffold tube to a steel or timber beam. They consist of two fixed clamps and a swiveling clamp that can be adjusted to fit the tube and the beam.	
Gravlock Coupler	Gravlock couplers are used to connect two scaffold tubes at any angle. They consist of a clamp with a wedge that can be tightened or loosened to connect the two tubes.	

Table 2.1.1 Types of Couplers used in Scaffolding

The type of coupler used will depend on the specific requirements of the job and the configuration of the scaffolding structure. It is important to ensure that the couplers used are compatible with the scaffold tubes, rated for the maximum load capacity, and regularly inspected and maintained to ensure the safety of workers and the stability of the scaffolding structure.

2.1.3. Types of Pipes used in Scaffolding

There are several types of pipes used in scaffolding. Some of the most common types include:

Pipes	Description	Images
Black Steel Pipes	These are the most commonly used pipes in scaffolding. They are made of carbon steel and are known for their strength, durability, and resistance to wear and tear.	
Galvanized Steel Pipes	These pipes are coated with a layer of zinc to protect them from corrosion and rust. They are more expensive than black steel pipes, but are preferred for outdoor use and in environments with high humidity.	
Aluminium Pipes	Aluminium pipes are lightweight and strong, making them a popular choice for scaffolding. They are resistant to corrosion and rust and are easy to handle and transport.	
Composite Pipes	Composite pipes are made of a combination of materials, such as fiberglass and plastic, and are lightweight, durable, and easy to handle.	

Table 2.1.2 Types of Pipes used in Scaffolding

The type of pipe used will depend on the specific requirements of the job and the load capacity of the scaffold structure. It is important to ensure that the pipes used are of high quality and are regularly inspected and maintained to ensure the safety of workers and the stability of the scaffolding structure.

2.1.4 Materials, Tools and Equipment used in Pipe and Coupler Scaffolding

Pipe and coupler scaffolding is a popular type of scaffolding used in construction and maintenance work. The materials, tools, and equipment used in pipe and coupler scaffolding include:

Materials, Tools and Equipment	Description	Images
Pipes	The most important material used in pipe and coupler scaffolding is steel pipes. The standard size of steel pipes used in scaffolding is 1.5 inches in diameter and 21 feet in length. The pipes are usually made of galvanized steel to prevent rusting and corrosion.	
Couplers	Couplers are used to connect two pipes together to form the scaffolding structure. There are different types of couplers used in scaffolding, including swivel couplers, putlog couplers, double couplers, and sleeve couplers. The standard size of couplers used in scaffolding is 48.3mm.	
Base plates	Base plates are used to provide a stable and level base for the scaffolding structure. The standard size of base plates used in scaffolding is 150mm x 150mm.	
Ledgers	Ledgers are horizontal tubes that are used to connect the vertical tubes (uprights) of the scaffolding structure. The standard size of ledgers used in scaffolding is 1.2m in length.	
Transoms	Transoms are horizontal tubes that are used to connect two or more ledgers to form a working platform. The standard size of transoms used in scaffolding is 0.6m in length.	
Braces	Braces are diagonal tubes that are used to provide stability and rigidity to the scaffolding structure. The standard size of braces used in scaffolding is 2.5m in length.	
Toe boards	Toe boards are placed along the edges of the working platform to prevent tools and materials from falling off the scaffold. The standard size of toe boards used in scaffolding is 150mm in height.	

Materials, Tools and Equipment	Description	Images
Scaffold boards	Scaffold boards are used to create a safe and stable working platform for workers. The standard size of scaffold boards used in scaffolding is 38mm in thickness and 225mm in width.	
Ladders	Ladders are used to access the working platform of the scaffolding structure. The standard size of ladders used in scaffolding is 3m in length.	
Safety harnesses	Safety harnesses are used to protect workers from falls while working on the scaffolding structure. The standard size of safety harnesses varies depending on the worker's size and weight.	

Table 2.1.3 Materials, Tools and Equipment used in Pipe and Coupler Scaffolding

It's important to note that the sizes of materials, tools, and equipment used in pipe and coupler scaffolding may vary depending on the specific requirements of the job and the regulations in the local area.

2.1.5. Selection of Pipes and Couplers

The selection of pipes and couplers for scaffolding structures will depend on the specific requirements of the job at hand, including load capacity, height, compatibility, durability, and ease of assembly. It is important to select pipes and couplers that are fit for purpose and to ensure that they are regularly inspected and maintained to ensure the safety of workers and the stability of the scaffolding structure. Some of the criteria for selecting pipes and couplers based on types of work are:

1. **Load Capacity:** One of the main considerations when selecting pipes and couplers is their load capacity. The size and thickness of the pipes, as well as the type and strength of the couplers, should be able to support the weight of the scaffolding platform, workers, and equipment. The maximum load capacity should be clearly specified by the manufacturer and should be based on the type of work that will be carried out.
2. **Height:** The height of the scaffolding structure will also determine the type and length of pipes and couplers that are needed. For instance, longer pipes may be required to reach greater heights, and more robust couplers may be necessary to provide stability and safety.
3. **Compatibility:** The pipes and couplers used should be compatible with each other, and with any existing scaffolding components on the site. Swivel couplers and right angle couplers can be used together, but it is important to ensure that the size and type of the couplers match the dimensions of the scaffold tubes and that they are rated for the maximum load capacity of the scaffolding structure.
4. **Durability:** The type and quality of the pipes and couplers selected should be durable enough to withstand the rigors of the job and the environment. They should be able to withstand wear and tear, and exposure to elements such as wind, rain, and temperature fluctuations.
5. **Ease of Assembly:** The pipes and couplers selected should be easy to assemble and disassemble. The ease of assembly will depend on the type of couplers used. For example, swivel couplers are generally easier to assemble than right angle couplers.

2.1.6. Standard Procedure for Erection of Scaffold using Pipes and Couplers

The sequence and standard procedure for the erection of scaffold using pipes and couplers can vary depending on the specific job requirements. It is important to follow the manufacturer's instructions and any applicable regulations and standards when erecting a scaffold using pipes and couplers. Proper training and experience in scaffolding erection is also essential to ensure the safety of workers and the stability of the scaffold structure.

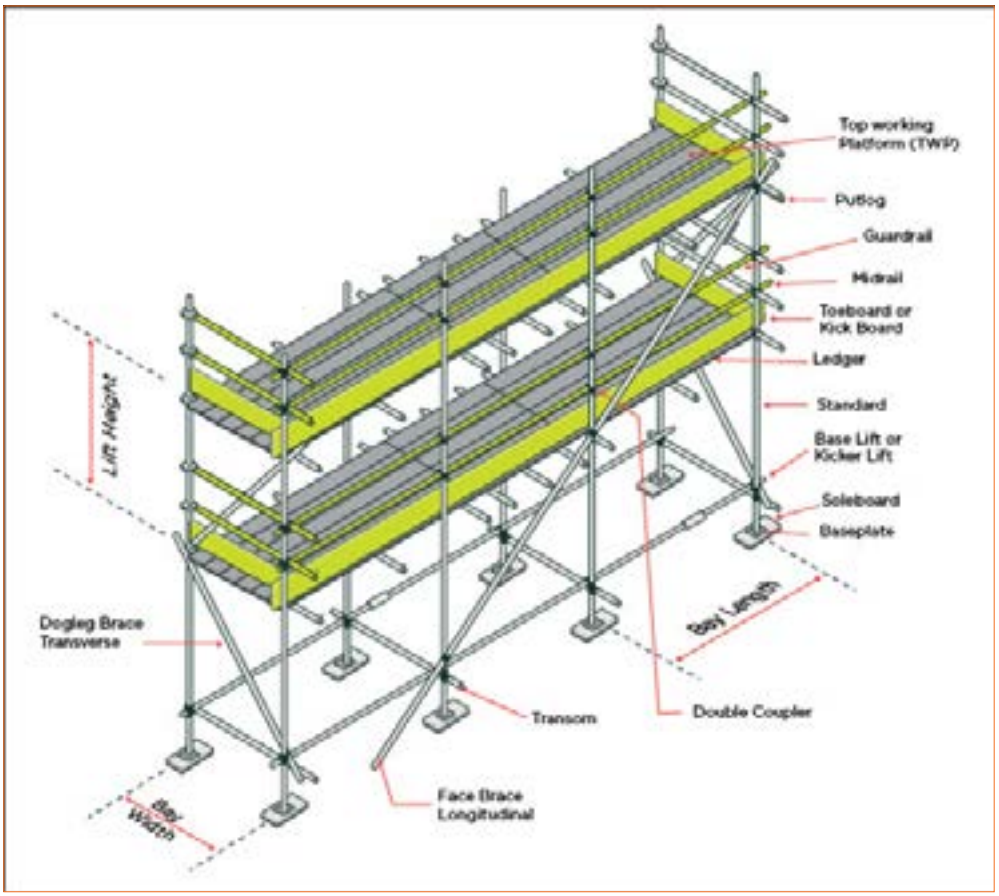

Fig. 2.1.2 Scaffolding Erection

(Source: https://www.linkedin.com/pulse/inspection-tube-fitting-type-scaffolding-hasan-shirazi-pe-bsc-ceng)

The sequence and standard procedure has following steps:

1. **Planning:** Before beginning the scaffold erection, a thorough assessment of the job site and the scaffold design should be carried out to determine the specific requirements for the scaffold, such as height, platform spacing, and load capacity.
2. **Lay the Base:** The first step in the erection process is to lay the base or sole plates, which are used to support the scaffold and distribute the weight across the ground. The base should be level and properly secured to prevent any movement during the erection process.
3. **Build the Standards:** The standards are the vertical pipes that form the framework of the scaffold. These pipes are connected using couplers to form a sturdy and stable structure. The standards are erected at intervals along the base, with the distance between them determined by the platform height.
4. **Add the Ledgers:** The ledgers are the horizontal pipes that connect the standards and provide support for the scaffold planks. They are placed perpendicular to the standards and are connected using couplers.

5. **Install Bracing:** Bracing is installed to provide additional stability to the scaffold. It is typically installed diagonally between the standards and ledgers and should be installed in both directions.
6. **Install Scaffold Planks:** The scaffold planks are placed on the ledgers to create a platform for workers to stand on. The planks should be properly secured and should be level and able to support the required load.
7. **Add Handrails and Toeboards:** Handrails and toeboards are added to the scaffold to provide additional safety for workers. They are installed along the edges of the platform to prevent falls.
8. **Inspect the Scaffold:** Once the scaffold has been erected, it should be inspected to ensure that it is stable and safe for workers to use. Any defects or issues should be addressed before the scaffold is used.

2.1.7. Preparatory Works for Scaffold Erection

The preparatory works for scaffold erection, including marking and transferring of levels should have following steps:

1. **Prepare the Work Area:** Clear the area of any debris or obstacles that could interfere with the scaffold erection process.
2. **Identify the Location and Height of the Scaffold:** Determine the desired height and location of the scaffold, and mark the ground with chalk or spray paint.
3. **Install the Sole Plates:** Place the sole plates, which are flat steel plates, at each of the scaffold's corner locations.
4. **Erect the First Standard:** Install the first standard, which is a vertical pipe, into one of the sole plates. Use a spirit level to ensure that it is plumb.
5. **Install the Second Standard:** Install the second standard into another sole plate, and use a spirit level to ensure that it is at the same height and plumb as the first standard.
6. **Connect the Ledger Beam:** Connect the ledger beam, which is a horizontal pipe, to the two standards at one end of the scaffold.
7. **Connect the Diagonal Brace:** Connect a diagonal brace, which is a pipe that runs from the ledger beam to the first standard, to provide stability to the scaffold.
8. **Repeat the process:** Repeat the process on the other end of the scaffold, installing the remaining standards, ledger beams, and diagonal braces.

9. **Mark the Levels:** Use a spirit level to mark the levels of the scaffold on each standard, to ensure that the working platform is level.

10. **Transfer levels:** Transfer the level marks to the ledger beams, to ensure that the working platform is level and secure.

By following these steps, workers can ensure that the scaffold is erected safely and efficiently, and that the working platform is level and secure. It is important to keep in mind that each step should be carried out carefully, and that workers should be properly trained and equipped to perform scaffold erection work.

2.1.8. Preparation of Base for Pipe and Coupler Scaffolding Work

The preparation of the base for pipe and coupler scaffolding work is an important step in the scaffolding erection process to ensure the stability and safety of the scaffold structure.

Here are the steps to prepare the base for pipe and coupler scaffolding work:

1. **Site Preparation:** The first step is to ensure that the site is clear of any debris, obstacles, or hazardous materials that could interfere with the erection process. This includes any overhead power lines, trees, or structures that may be in the way.

2. **Ground Preparation:** The ground where the scaffold is to be erected should be level and free from any uneven or soft areas. Soft spots can lead to the scaffold sinking and become unstable, which can lead to accidents.

3. **Lay the Sole Plates:** The sole plates are used to distribute the weight of the scaffold across the ground, and to provide a solid base for the scaffold structure. They should be made of steel or other suitable materials and should be placed at intervals along the ground where the scaffold is to be erected.

4. **Secure the Sole Plates:** Once the sole plates have been laid, they should be properly secured to prevent any movement during the erection process. This is typically done by using stakes or anchors to hold the plates in place.

5. **Level the Sole Plates:** The sole plates should be level to ensure that the scaffold structure is stable and safe for workers to use. This can be done using a spirit level or other levelling tool.

6. Mark the Location: Once the sole plates are in place and properly secured, the location of the scaffold structure should be marked to ensure that it is erected in the correct position.

2.1.9. Importance of Providing Supports to Scaffold

Providing supports to a scaffold is crucial to ensure its stability and safety for workers using it. The supports help distribute the weight of the scaffold evenly and prevent it from collapsing, which can lead to serious injuries or fatalities. Providing supports to a scaffold is an essential part of the scaffold erection process. It is important to follow the manufacturer's instructions and any applicable regulations and standards to ensure that the scaffold is properly supported and safe for workers to use.

Here are some reasons why providing supports to a scaffold is important:

1. **Stability:** A scaffold that is not properly supported can be unstable, which can lead to workers losing their balance and falling from the platform. Providing supports to the scaffold helps keep it stable and prevents it from swaying or shifting.
2. **Load Capacity:** A scaffold that is not properly supported can collapse under the weight of workers and materials. Providing supports helps distribute the weight of the scaffold and its contents evenly, allowing it to safely support the required load.
3. **Safety:** Providing supports to a scaffold is essential to ensure the safety of workers who are using it. A collapsed scaffold can lead to serious injuries or fatalities, and proper support can help prevent these accidents from occurring.
4. **Compliance:** Many regulatory authorities require that scaffolds be properly supported to ensure worker safety. Failure to provide proper supports can result in legal liabilities and fines.

2.1.10. Process of Providing Support in a Pipe and Coupler Scaffolding Works

To provide support in a pipe and coupler scaffolding work, follow these steps:

1. Start by ensuring that the base plates and sole plates are level and anchored to the ground, to provide a stable foundation for the scaffold.
2. Connect the vertical pipes (standards) to the base plates using couplers, ensuring that they are plumb and straight up and down.
3. Connect the ledger beams to the standards using swivel couplers, ensuring that they are level and horizontal.
4. Install diagonal braces, which are essential for providing lateral support to the scaffold and preventing it from wobbling or swaying. The diagonal braces should be installed in an X pattern between the standards and ledger beams, and tightened with right-angle couplers.
5. Install toe boards and guard rails at the edges of the scaffold to prevent workers and materials from falling off. Toe boards are installed at the bottom of the scaffold, while guard rails are installed at the top of the scaffold.

6. Add scaffold boards to create the working platform.

7. It is important to ensure that the scaffold structure is stable and secure before allowing workers to use it. Any issues with support or stability should be addressed immediately to avoid accidents or injury.

2.1.11. Lifting and Shifting of Scaffold Materials

Slings, shackles, and belts are important components for the safe and efficient lifting and shifting of scaffold materials. When using these components, it's important to ensure that they are properly rated for the weight of the load and the lifting equipment being used, that they are properly attached and secured, and that the load is properly balanced and centered. Each of these components plays a specific role in ensuring the safe and efficient transport of heavy loads.

1. **Slings:** Slings are flexible straps made from materials such as nylon or wire rope, and they are designed to wrap around loads to be lifted. They come in different types, including flat webbing slings, round slings, and wire rope slings. Slings are commonly used for lifting scaffold materials such as steel pipes, scaffolding frames, and planks. When using slings, it's important to ensure that they are properly rated for the weight of the load and the lifting equipment being used. Slings should be properly wrapped around the load to prevent slipping, and the load should be balanced and centered to prevent it from swinging or tipping.

Fig. 2.1.3 Double Leg Rope Slings (Source: https://www.liftingequipmentstore.com/product/double-leg-18mm-wire-rope-sling-5-8-tonne)

2. **Shackles:** Shackles are U-shaped metal components with a pin or bolt that passes through the ends of the U. They are used to connect slings or other lifting components to the load or lifting equipment. Shackles come in different types and sizes, including anchor shackles and chain shackles. When using shackles, it's important to ensure that they are properly rated for the weight of the load and the lifting equipment being used. They should be properly attached to the load or lifting equipment, and the pin or bolt should be properly secured.

Fig. 2.1.4 Types of Shackles (Source: https://www.liftinggeardirect.co.uk/blog?blogger_id=34)

3. **Belts:** Belts are used to secure and hold scaffold materials in place during transport. They are made from materials such as nylon or polyester and are available in different widths and lengths. Belts are commonly used to secure scaffold planks to scaffolding frames or to secure loads on trucks or trailers. When using belts, it's important to ensure that they are properly rated for the weight of the load and that they are properly tightened to prevent slipping or shifting during transport.

Fig. 2.1.5 Tool holding Belt (Source: https://www.ebay.com.au/itm/271125209837)

2.1.12. Measuring, Marking and Levelling Tools for Scaffold Erection Works

Measuring, marking, and levelling tools are essential for scaffold erection works, as they ensure that the scaffold is erected safely and securely. There are several types of measuring, marking, and levelling tools that can be used, including:

1. **Tape Measure:** A tape measure is used to measure the length, width, and height of the scaffold. It is also used to measure the distance between scaffolding components, such as the distance between scaffold frames or the length of scaffold planks. A tape measure is an essential tool for scaffold erection work, as it helps ensure that the scaffold is erected to the correct dimensions.

Fig. 2.1.6 Tape Measure (Source: https://www.scaffolding-direct.co.uk/tape-measure-8m-27ft-heavy-duty-scaffolders-tape.aspx)

2. **Spirit Level:** A spirit level is used to ensure that scaffold components are level and plumb. It can be used to check the level of scaffold frames, planks, and other components. A spirit level is an important tool for scaffold erection work, as it helps ensure that the scaffold is erected safely and securely.

Fig. 2.1.7 Spirit Level (Source: https://www.aspire-international.com/products/triple-indicating-scaffold-spirit-level/)

3. **Chalk Line:** A chalk line is used to mark a straight line on a surface. It is commonly used in scaffold erection work to mark the location of scaffold frames or the position of scaffold planks. A chalk line is an efficient tool for scaffold erection work, as it allows for quick and accurate marking of the scaffold structure.

Fig. 2.1.8 Chalk Line (Source: https://canberradiamondblade.com.au/reasons-to-use-chalk-line/)

4. **Laser Level:** A laser level is a more advanced type of leveling tool that uses a laser beam to project a level line or plumb line. It is commonly used in scaffold erection work to ensure that scaffold components are level and plumb. A laser level is a precise tool for scaffold erection work, as it provides an accurate level or plumb line.

Fig. 2.1.9 Laser Level (Source: https://www.911metallurgist.com/blog/laser-levels)

5. **Angle Finder:** An angle finder is used to measure angles, which is useful in scaffold erection work when it comes to determining the angle of diagonal braces or the angle of scaffolding components. This tool helps ensure that the scaffolding is erected at the correct angles and is safe for workers.

Fig. 2.1.10 Angle Finder (Source: https://www.amazon.in/5-Digital-Angle-Finder-Rule/dp/B00563TM32)

2.1.13. Checks for Alignment as per Instruction in Pipes and Coupler Scaffolding

To check for alignment in pipes and coupler scaffolding, follow these steps:

1. Start by verifying that the base plates and sole plates are level and correctly positioned, and that they are anchored to the ground.
2. Check that the standards (vertical pipes) are plumb and vertically aligned, using a spirit level or plumb bob to ensure that they are straight up and down. Adjust as necessary.
3. Make sure that the ledger beams (horizontal pipes) are level and aligned horizontally, using a spirit level to check that they are straight. Adjust as necessary.
4. Ensure that diagonal braces are fitted at the correct angles, and that they are tightened with the couplers.
5. Verify that all couplers are tightly fastened and correctly positioned to ensure that the scaffold structure is secure.
6. Check that the scaffold boards are securely in place, and that they are level and aligned horizontally.
7. Finally, make sure that all toe boards and guard rails are installed and secured in place for worker safety.

It is important to perform regular checks throughout the scaffolding work to ensure that the structure remains stable and secure. Any issues with alignment or stability should be addressed immediately to avoid accidents or injury.

2.1.14. Dismantling of a Pipe and Coupler Scaffold

The dismantling of a pipe and coupler scaffold should be carried out with the same care and attention to safety as the erection of the scaffold. The standard procedure for dismantling a pipe and coupler scaffold in single or double staging is:

1. Remove all Tools and Materials from the Scaffold: Before beginning the dismantle process, remove all tools and materials from the scaffold to prevent tripping hazards.
2. Remove the Working Platform: Start by removing the working platform from the highest level of the scaffold. Be sure to clear the platform of all debris and materials before removing it.
3. Remove the Guardrails and Toe-Boards: After removing the working platform, remove the guardrails and toe-boards from each level of the scaffold.
4. Remove the Horizontal and Diagonal Braces: The next step is to remove the horizontal and diagonal braces that provide stability to the scaffold. Begin at the highest level of the scaffold and work downwards.

5. Remove the Ledger Beams: After removing the braces, remove the ledger beams from each level of the scaffold.
6. Remove the Standards: The final step is to remove the standards, which are the vertical pipes that support the scaffold. Begin at the highest level and work downwards, removing one standard at a time. Be sure to use proper lifting techniques to avoid injury.
7. Inspect Components: As each component is removed, inspect it for damage or defects. Any damaged or defective components should be repaired or replaced before the next use.
8. Store Components: Store all components in a secure and dry location, to prevent damage or deterioration.

It is important to follow the above procedure for dismantling a pipe and coupler scaffold to ensure that it is done safely and efficiently. By following these procedures, workers can minimize the risk of injury, and ensure that the scaffold can be reused safely in the future.

2.1.15. Stacking and Storing Materials used in Pipe and Coupler Scaffolding Work

Pipe and coupler scaffolding is a popular method of erecting temporary structures in construction work. It involves using steel pipes and couplers to create a scaffold system that can support workers and materials. Stacking and storing materials used in pipe and coupler scaffolding work is an important aspect of this process, as it ensures the safety of workers and the stability of the structure.

The process of stacking and storing materials used in pipe and coupler scaffolding work can be broken down into the following steps:

- **Identify the materials needed:** Before beginning the scaffolding work, it is important to identify the materials that will be needed. These may include steel pipes, couplers, planks, guardrails, and other components.
- **Inspect the materials:** Once the materials have been identified, they should be inspected for any damage or defects. Any damaged or defective components should be replaced to ensure the safety of the workers.
- **Sort and organize the materials:** The materials should then be sorted and organized according to their size and type. This will make it easier to access the materials when they are needed and help prevent accidents.
- **Stack the materials:** The steel pipes should be stacked in a stable manner, with the largest and heaviest pipes at the bottom. The pipes should be placed in a vertical position, with the ends of the pipes supported by the couplers.

- **Store the materials:** The materials should be stored in a secure location, such as a storage area or a designated scaffolding area. The area should be clearly marked and fenced off to prevent unauthorized access.
- **Label the materials:** Each component should be labeled with its size and type to make it easier to identify and access when needed.
- **Maintain the materials:** The materials should be regularly inspected and maintained to ensure that they remain in good condition. Any damaged or defective components should be replaced immediately.

By following these steps, the stacking and storing of materials used in pipe and coupler scaffolding work can be done safely and efficiently. This will help to ensure the safety of workers and the stability of the structure.

2.1.16. Measures Taken for Protection of Work and Work Area

When working with pipe and coupler scaffolding, it is important to take measures to protect both the workers and the work area near the scaffold. Here are some measures that can be taken to ensure the safety of the work and work area:

1. **Guardrails:** Guardrails should be installed around the perimeter of the scaffold to prevent workers from falling off the platform. The guardrails should be at least 39 inches high and be able to withstand a force of 200 pounds.
2. **Toeboards:** Toeboards should be installed around the base of the scaffold to prevent tools or debris from falling onto people or equipment below. The toeboards should be at least 4 inches high and be securely fastened to the scaffold.
3. **Barricades:** Barricades should be used to prevent unauthorized access to the work area around the scaffold. The barricades can be made of rope or other suitable materials and should be clearly marked with warning signs.
4. **Personal Protective Equipment (PPE):** Workers should wear PPE, such as hard hats and safety shoes, to protect themselves from falling objects or other hazards associated with the work.
5. **Inspection:** The scaffold should be inspected regularly to ensure that it is in good condition and that all safety features are in place and functioning properly. Any defects or safety hazards should be immediately addressed and corrected.
6. **Training:** Workers should be trained on the proper use of the scaffold, including safety procedures and the correct way to erect and dismantle the scaffold. Workers should also be trained on how to identify and report safety hazards.

By implementing these measures, the work and work area near pipe and coupler scaffolding can be protected, which is crucial to ensure the safety of workers and others in the area.

2.1.17. Upkeep, Repair and Maintenance of Tools

Maintaining the tools used for pipes and couplers scaffolding is essential to ensure safe and efficient work. Here are some key points to keep in mind regarding upkeep, repair, and maintenance of these tools:

1. **Inspect tools regularly:** Inspect tools before each use for signs of damage or wear. Replace any damaged or worn tools.
2. **Clean and lubricate tools:** Clean and lubricate all tools regularly to keep them in good working condition.
3. **Store tools properly:** Store tools in a dry and secure location, to prevent rust and damage.
4. Keep tools organized: Keep tools organized in a tool box or tool belt to make them easily accessible and prevent loss or damage.
5. **Replace worn parts:** Replace any worn or damaged parts on tools, such as blades, handles, or grips.
6. **Follow manufacturer's instructions:** Follow the manufacturer's instructions for using, cleaning, and maintaining tools, to ensure their longevity and safe operation.
7. **Seek professional repair:** If a tool is severely damaged or not functioning properly, seek professional repair or replacement.

By following these tips, workers can ensure that their tools are in good working condition and safe to use. It is important to keep in mind that damaged or worn tools can compromise the safety of the scaffold and lead to accidents or injuries. Therefore, regular maintenance and inspection of tools is crucial for safe and efficient work.

Exercise

1. List the materials, tools and equipment used in pipe and coupler scaffolding.
2. How do you select pipes and couplers?
3. Give the standard procedure for erection of scaffold using pipes and couplers.
4. What are steps to prepare the base for pipe and coupler scaffolding work?
5. What is the standard procedure for dismantling a pipe and coupler scaffold in single or double staging?

Notes

Scan the QR code to watch the video

https://youtu.be/-4tEehOJa-k

Pipes and Couplers Scaffolding

https://youtu.be/PvapBkb2rzQ

Types of Couplers used in Scaffolding

https://youtu.be/aL7zETeQEe0

Types of Pipes used in Scaffolding

https://youtu.be/pktNG6YyMns

Materials, Tools and Equipment used in Pipe and Coupler Scaffolding

3. Assist in the erection and dismantling of common customized system scaffold

Unit 3.1- Carry out preparatory works for erection of common customized system scaffold

Unit 3.2- Erect and maintain common customized system scaffold

Unit 3.3- Dismantle common customized system scaffold

(CON/N0355)

Key Learning Outcomes

By the end of this module, participants will be able to:

- Explain the different types of customized scaffolds
- Explain the application of various types of customized scaffolds
- List the customized scaffolds along with their standard sizes
- Explain the application of customized scaffolds
- Define the process of stacking and storing of various materials based upon work requirements.
- Demonstrate application of slings, shackles, and belts for lifting and shifting of scaffold materials
- Use measuring, marking and levelling tools
- Describe common defects in components
- Identify common defects in components of customised scaffold
- Explain process of preparation of base
- Describe the measures taken for protection of work and work area
- Define the criteria for selection of components, tools and equipment etc. as per the types of work
- Explain the standard procedure for erection of scaffold using in various customized scaffolds
- Discuss importance of providing supports to scaffolds
- Discuss the upkeep, repair and maintenance of tools
- Demonstrate preparation of base for customized scaffolds
- Demonstrate the erection of customized scaffolds up to specified height
- Demonstrate checks for alignment of scaffold as per instruction
- Demonstrate the process of providing support in customized scaffolds
- Demonstrate the dismantling of customized scaffolds

Unit 3.1 Carry out preparatory works for erection of common customized system scaffold

Unit Objectives

By the end of this unit, participants will be able to:

- Explain the different types of customized scaffolds
- Explain the application of various types of customized scaffolds
- List the customized scaffolds along with their standard sizes
- Explain the application of customized scaffolds
- Define the process of stacking and storing of various materials based upon work requirements.
- Use measuring, marking and levelling tools
- Describe common defects in components
- Identify common defects in components of customised scaffold
- Discuss the upkeep, repair and maintenance of tools

3.1.1. Scaffolding

Scaffolding is a vital tool in construction projects. It allows workers to access higher, harder to reach areas with ease. Customized scaffolding is a specialized, customized form of scaffolding that is tailored to meet specific needs.

Customized scaffolds can be used in wide range of applications, from residential construction to industrial construction. Customized scaffolds can be used to support workers in accessing difficult to reach areas, such as high up on buildings or on the face of a large industrial structure. It can be designed to fit in tight, confined spaces, and can be used to carry out complex tasks, such as painting and plastering. Customized scaffolds can be designed to meet the specific requirements of the project, such as the size and shape, and can be made with appropriate materials, such as timber and steel.

3.1.2. Types of Scaffolds

Scaffolding types change depending on the sort of construction work being done to get access to structures at a height. When supporting heavy loads from building materials like bricks, blocks, stucco, or cast-in-place concrete, they are sometimes used to support workers and their tools, while other times they are called "shoring" instead of "scaffolding."

The following provides the key details regarding the various scaffolding types, their applications, components, and the areas in which they are most frequently used:

1. **Wooden & Bamboo Scaffolding:** Wooden scaffolding is used practically everywhere. Before steel and cheaper manufacture of materials, pre-cut lumber was the most used type of scaffolding.

   Bamboo scaffolding is manufactured from bamboo and is widely used all over the world, but is especially popular in Asia and Hong Kong because of its durability, adaptability, and environmental friendliness. Bamboo is harvested in nations with tropical climates because it can grow swiftly and robustly for use as scaffolding material.

   Forty percent of the known bamboo species in the world, or 500 species, are found in China. However, due to worries about safety, bamboo has largely been abandoned as a construction material throughout most of China.

2. **Single or Brick layer Scaffoldings:** It is referred to as brick layer's scaffolding and is frequently used for brick brickwork. Standards, ledgers, putlogs, and other components make up single scaffolding, which is parallel to the wall at a distance of roughly 1.2 metres. In this, a row of Standards—vertical bamboo or wood members—are firmly embedded into the ground in a plane parallel to the building wall.

   The space between two standards is typically maintained between 2.4 and 3 metres. The putlogs, or transverse horizontal members, are positioned with a 120 cm horizontal gap between them, with one end resting on the ledgers and the other end being secured in the wall's holes. The putlogs are secured to the ledgers using rope lashing.

   When the height of the scaffolding is particularly high, diagonal members, or braces, are occasionally inserted to preserve its stability. With rope lashing, braces are cross-diagonally attached to the standards.

3. **Double or Mason's Scaffolding:** Stone masonry frequently uses double scaffolding, also known as mason's scaffolding. It is more durable than the scaffold used by the bricklayer. It is challenging to drill putlog support holes in stone walls. As a result, the scaffolding is built in two rows to increase its strength, as opposed to the single row of scaffolding used by bricklayers, which is fastened into the ground.

   The first row is 20 to 30 cm from the wall, and the second row is one metre distant. Putlogs are not fixed with the wall in this instance. On ledgers, put logs are supported at both ends. But one end of the putlog is fastened to the wall in the scaffolding for the bricklayer.

Rakers and cross bracing are offered to make it sturdy. Moreover, no holes need to be drilled in the wall's surface. Because of this, they are also known as independent scaffolds. Raking beaches may occasionally be offered to stop scaffolding from slipping away from the wall.

4. **Tubular Scaffolding:** Steel couplers or fittings are used to assemble or Tubular scaffolding, which is constructed from steel pipes and tubes. It is incredibly simple to put together or take apart. It is stronger, more resilient, and more fire resistant. Although it is not cost-effective, it will increase worker and construction material safety. As a result, it is frequently used today.

   Mason's scaffolding and steel scaffolding are both preferable to each other. In this instance, steel tubes with a diameter of 40 mm to 60 mm are used in place of lumber, special types of steel couples are used for fastening in place of rope, and the standards are set on the base plate rather than being fixed into the ground.

   The distance between adjacent standards in a steel scaffolding structure is typically kept between 2.5 and 3 metres. Welding is used to secure these standards to a base plate, which is a square or circular steel plate. Every 1.8 m climb has a ledger spaced every 1.8 m. The putlogs typically range in length from 1.2 to 1.8 metres.

   Compared to other types of scaffolding, tubular scaffolding offers various benefits, including:

   - Compared to bamboo or timber scaffolding, steel scaffolding is easier to install and take down. By doing this, building time is reduced.
   - It is longer lasting than wood, making it more cost-effective over time.
   - It is more capable of withstanding fire.
   - Working at any height is more suitable and secure for scaffolding workers.

5. **Tube & Clamp Scaffolding:** Tubing and Clamp One of the first varieties of steel scaffolding, scaffolding is composed of two sections, comprising the tubes and clips, or "couples," that go together. To create the scaffold, lengthy sections of tubes must be connected together, and the verticals and horizontals must be joined with clamps designed especially for these tubes.

   The verticals can be placed on this scaffolding system in any way that is necessary for the job at hand. This type of scaffolding is a suitable option for areas with tough weather because the steel is specially engineered to guard against rust and corrosion.

6. **Cantilever or Needle Scaffolding:** The standard is set at a height above the ground in needle scaffolding as opposed to being fixed into the ground. The needle is the structure that holds the stands. A wooden cantilever construction that extends from wall holes is called a needle.

   Cantilever scaffolding, also known as needle scaffolding, is a temporary platform for supporting construction work in which the standards are held up by a series of needles that are inserted through holes in the wall.

It is known as single frame type scaffolding for this reason. The other style is referred to as independent or double frame type scaffolding and involves strutting needles through apertures in the floors.

The following circumstances call for the usage of cantilever or needle scaffolding:

- When it is either impossible to anchor standards into the ground or when the ground is not capable of supporting standards.
- When a busy street is being built on and the area next to the wall needs to be clear of vehicles.
- When a tall building is being built and the upper portion of the wall is being constructed, construction is being done at a very high elevation.

7. **Suspended or Swinging Scaffolding:** Suspended or Swinging scaffolding refers to a working platform that is suspended from roofs using wire ropes, chains, etc. and that may be raised or lowered to the desired level. When very tall structures require only light-duty access for ongoing building maintenance, repairs, painting, and minor modifications, suspended scaffolds can offer significant cost savings.

8. **Systems Scaffolding:** The term "system scaffolding" can also refer to modular scaffolding, is mostly made up of vertical and horizontal pre-engineered parts that are connected in a systematic way. There are hundreds of manufacturers, each with different efficiency, and it is perhaps the most used kind of scaffolding in the world.

   Some are more effective under extremely heavy loads, while others are better suited to smaller repetitive scaffold designs. Systems scaffolding refers to a broad category of scaffolding that can be utilised to design uniform scaffolding bays. The following are a few of the most common types of system scaffolding:

   a. **Cuplock Systems Scaffolding:** Galvanized steel is typically used to make cuplock systems scaffolding. Because of its capacity to support large loads, it is trustworthy and relevant. Galvanized steel cuplocks spaced every 500 to 1,000 mm produce a scaffolding base with a highly standardized structure that works well for designs with repetitive patterns.

   b. **Kwikstage Scaffolding:** Kwikstage Scaffolding is a modular stage scaffolding system that can be quickly assembled. It is employed in construction, tower construction, and the support of concrete formwork. As a tool for scaffolding standards, it is primarily preferred in Australia and the UK.

      Kwikstage is quick to construct and reasonably versatile, working well for both commercial and residential applications. It requires only five components and is simple to put together and take apart. Kwikstage's safety and dependability are increased by the inclusion of double guard rails and non-slip platforms.

c. **Haki Staircase Towers:** The Haki Stair Tower system is made up of Haki universal standards, guardrails, diagonal braces, beams, as well as various parts made especially for stair towers, such stair flights, landings, toe-boards, etc. Its parts have hot-dip galvanised finishes.

In some circumstances, a stair tower is employed on its own. These stairs are a component of the scaffolding system that allows the workers to move from level to level. These scaffolds are also intended to protect workers and provide them with short-term access to a particular area of the building.

9. **Frame & Brace Scaffolding:** Frames, braces, planks, and bases make up fabricated frame and brace scaffolding. This scaffold is incredibly portable and easy to set up. It's crucial to remember that these lack system scaffolding's strength.\

Since they are adaptable, affordable, and simple to use in small-scale projects where scaffolding might be made mobile, fabricated frame and brace scaffolds are the most popular type of scaffold.

Residential contractors, painters, etc. usually utilise them in one or two tiers, but their modular frames can also be stacked several stories high for use on large-scale construction projects. In North America and Europe, this scaffolding is widely used for both residential and commercial uses.

10. **Mast Climbing Scaffolding:** Similar to suspended scaffolds, mast climbing scaffolding can reach different heights. It can ascend and descend on fixed mast constructions that are positioned on the ground as opposed to hanging from cables. Scaffolders who have to carry large weights favour it.

A mast climbing scaffold is used while building a brick or block wall since it can be adjusted to reach different heights in tiny steps. The height of these scaffolds varies; some are only a few floors high, while others rise many storeys.

Mast climbers are perfect for projects with little available ground space because they don't take up a lot of room at the base of the structure.

11. **Shoring Scaffolding:** A technique called shoring scaffolding holds up walls, ceilings, and ditches (shoring). They are made to mechanically telescope to a length that is roughly twice as long as their smallest length in order to fit through a variety of spaces.

The concrete is nearly often poured on top of a form to retain the liquid concrete until it hardens into a solid that can support itself if it is a concrete slab for a building floor. Scaffolds are most frequently used as the foundation for structures.

3.1.3. Scaffolding Components

Here are all the scaffolding components:

- **Standards.** This structure comprises of vertical elements supported on the ground, on drums, or by ground anchors.
- **Ledgers.** The length of a scaffold bay is defined by tubes with a case wedge fixing device positioned horizontally between two standards and defining the length of the scaffold bay.
- **Braces.** The braces are attached to the standards diagonally.
- **Putlogs.** A putlog connects the wall under construction to the ledger. A putlog hole is drilled into the side of a structure to accommodate a putlog.
- **Transoms.** A transom is a sort of ledger putlog that both ledgers support.
- **Bridle.** Bridles are used to bridge an opening in a wall by supporting one end of the putlog that is used to build the wall.
- **Boarding.** Boarders function as horizontal platforms for supporting workers and materials throughout the construction process.
- **Guard railings.** A rail installed at the same height as the ledger.
- **Toeboard.** A parallel arrangement of boards supported by putlogs that provides protection at the level of the working platform.
- **Ladder scaffolding.** Using scaffolding ladders, employees can simply mount and descend the erected structure.
- **Scaffolding wheels.** Wheels at the base of the scaffold that facilitate its mobility from one location to another.
- **Cup-lock:** Cup-lock Scaffolding is a temporary framework utilized to support a slab, work crew, and materials during the construction, maintenance, and repair of buildings, bridges, and all other man-made structures. Cup-lock is a galvanized or painted, multipurpose steel scaffolding system that is excellent for giving general access and supporting vertical loads. All vertical standards and ledgers tubes are 48.3mm diameter with 3.00 or 3.20 mm thickness.
- **H Frames:** Due to its features, H-frame scaffolding guarantees significant labour and time savings. Essentially, the system consists of interconnected frames. One H frame is 2 metres high, whereas the length between two H frames is 2.5 metres. In addition, auxiliary factors are utilized in this system:

    - Metal plank
    - Stairs with or lacking a landing
    - Adjustable base jack
    - Adjustable support

- Inclined floors are levelled with the aid of screws with a variable length. Steel work platforms improve the safety and durability of scaffolding. Passageways between floors are secure inside scaffolding with some applications such as staircase or access ladder. The use of a scaffolding clamp in jacketing operations improves scaffold safety and facilitates its deployment.

- **Pipes:** Galvanized scaffolding pipes are the most durable type of steel scaffold tubes. There are three distinct variations of galvanized steel scaffolding pipes. Include E-galvanized scaffolding pipes, GI pipes, and hot-dip galvanized steel pipes. HDG scaffold tubes are another term for hot-dip galvanized scaffolding pipe.

- **Bamboo:** In China and Hong Kong, bamboo scaffolding has replaced steel for numerous reasons. In reality, bamboo has a higher tensile strength than steel. It is also considerably less expensive and fully eco-friendly.

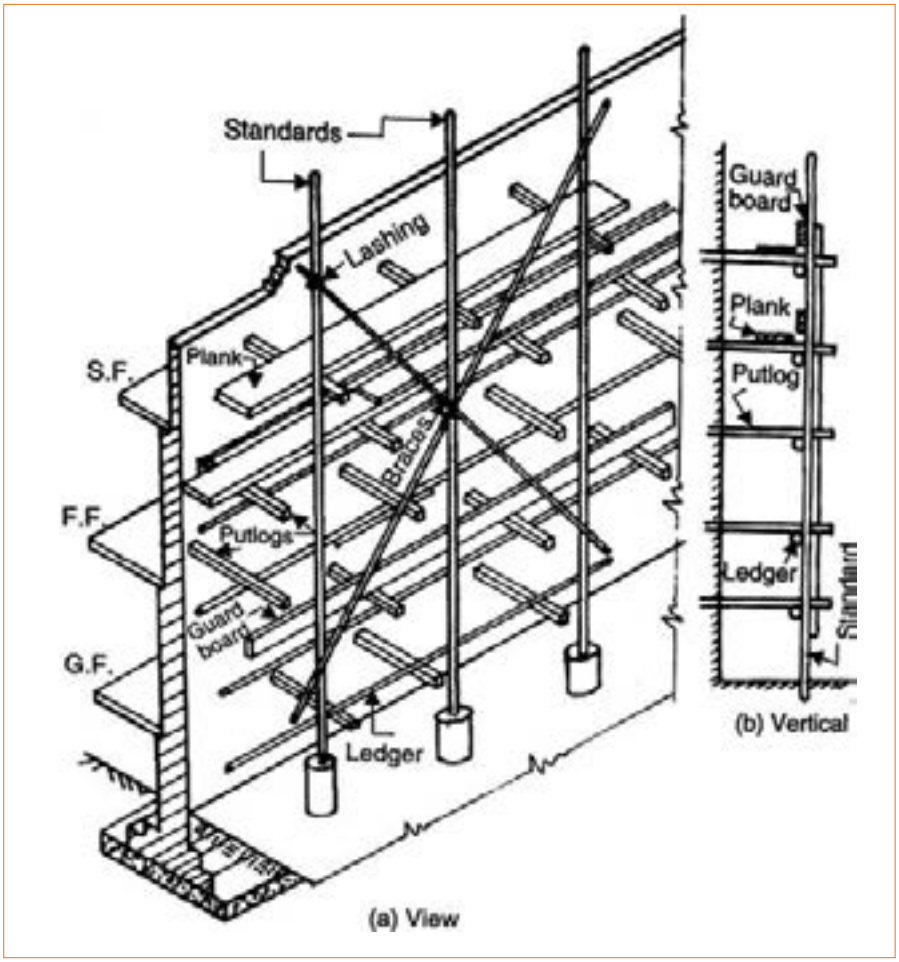

Fig. 3.1.1 Components of Scaffolding

3.1.4. Selection of Scaffolding and it components

The selection of the appropriate method for the task is the first step in making scaffolding safe and effective. Personnel are obliged to improvise and make do if the scaffold's fundamental qualities are inadequate for the work or if all the required components are not available. Accidents result under these circumstances.

Basic understanding of the site circumstances and the work to be done is necessary for the proper selection of scaffolding and related components.

These things should be taken into account:

- Weight that must be carried by the scaffold in terms of personnel, tools, supplies, and machinery
- Site circumstances (e.g., Interior, exterior, backfill, concrete floors, type and condition of walls, access for the equipment, variations in elevation, anchorage points)
- To what height or heights may the scaffold be erected?
- What sort of work will be performed from the scaffold? (e.g., Masonry work, sandblasting, painting, metal siding, mechanical installation, suspended ceiling installation)
- Work duration Experience of the crew and supervisor with the many types of scaffolds that are available
- Conditions for pedestrians crossing the scaffold and going underneath it
- upcoming weather conditions
- ladders or alternative means of platform access
- Obstructions
- Configuration of the structure or building under construction
- Unique erection or dismantling issues, such as giving the erector effective fall protection
- The use of machinery to make erecting the scaffold easier.

3.1.5. Inspection of components for defects

Welds, member straightness, and corrosion are the three basic areas of inspection. This holds true for every part of a scaffolding system.

1. **Corrosion:** Scaffolding equipment that is severely rusted or eroded is a sign of abuse or neglect.
2. **Straightness of members:** Improper handling, transportation, and storage could harm scaffolding equipment. Every part of the scaffolding should be straight and devoid of any bends, kinks, or dents.
3. **Welds:** Before using any equipment, it should be inspected for damaged welds. Any item that reveals damaged welds or rewelding beyond the original factory weld should not be used. The factory weld reference refers to where and how well rewelds are made.

   Although corrosion, straightness, and welds should be checked first, other component elements should also be examined.

4. Locking mechanisms on frames and braces must be functional, and if not, they must be fixed or replaced before use.
5. The frame or panel legs must be accurately aligned by coupling pins.
6. Pivoted cross braces require a tightly fastened centre pivot.
7. Caster brakes must function properly and must be repaired or replaced before usage if they are not.

Crucial Steps in inspection

- A competent individual must inspect scaffolding components, and as part of the normal scaffolding inspection, the state of the components should be checked on a regular basis.
- Never utilise excessively corroded or rusted scaffold in a scaffold installation.
- All damaged parts should be replaced or repaired by a qualified individual.
- While erecting, changing, and removing scaffolds, access to the manufacturer's manual for each system scaffold is required. The user should also receive information from this regarding how to keep the scaffold in excellent condition.

3.1.6. Tools used in Erection/Dismantle

The following hand tools are used in erecting or dismantling the scaffold:

1. **Good Pair of Boots & Gloves:** Falling is one of the accident categories that occurs most frequently on the job place. In many cases, the fall might have been avoided with better footing and a firmer grasp, regardless of whether it was caused by negligence or a defect in the scaffolding itself.

   A nice set of boots and gloves will be useful in this situation. When you have to climb scaffolding to reach the desired height, they are crucial to the job. Your feet's toes will be protected against falling objects by a sturdy pair of boots, especially steel-toed ones. One of the most typical kinds of injuries is this one. Moreover, their rubber soles offer stability.

   The gloves are necessary because they shield your hands from cuts and abrasions that could be brought on by the scaffolding's jagged edges. Also, they can assist you in holding tools and other items more securely while working.

Fig. 3.1.2 Boots

2. **Scaffold Wrench:** This is another component that is necessary for assembling scaffolding. The fasteners can be loosened if necessary in addition to tightening them using the scaffold wrench. When scaffolding needs to be replaced or adjusted on the job site, this is especially useful.

   A scaffold wrench can be beneficial for any bolts or nuts that are utilised on the job site in addition to scaffolding. A two-in-one wrench is required for this, allowing you to carry fewer tools. When working on scaffolding, the less tools you need to wear on your belt, the safer you are.

Fig. 3.1.3 Scaffolder Wrench

3. **Adjustable Wrench or Crescent Wrench:** When tightening the bolt with a scaffold wrench or scaffold ratchet, an adjustable wrench holds the nut in place. That does significantly speed up and simplify the task. Also, when working on the job, the adjustable wrench can be utilised to tighten or loosen other bolts.

Fig. 3.1.4 Adjustable Wrench

4. **Claw Hammer/ Scaffold Hammer:** A hammer is intended to deliver a large amount of force in a compact area. It is a long wooden stick connected to a metal block. The hammer is circular on one side and sharp on the other. The hammer is your closest friend whether you need to hammer something into place or smash something. However, ensure that the weight is appropriate for the user. When selecting a hammer, one must carefully consider the available sizes and weights.

Fig. 3.1.5 Hammer

5. **Pulleys:** A pulley is a simple machine composed of a rope and a wheel

with grooves. The rope fits into the wheel's groove, and pulling on the rope causes the wheel to rotate. Generally, pulleys are used to raise objects, particularly heavy ones. The item lifted by a pulley is referred to as the load.

Fig. 3.1.6 Pulley

6. **Hooks:** A double-action aluminium scaffold hook typically used in conjunction with a fall arrest safety lanyard for rapid attachment to scaffolding or steel structures.

Fig. 3.1.7 Hook

7. **Ropes:** Bundles of scaffolding rope coir yarn. In shapes such as bales, spools, dholls, and ropes. Cut to lengths suitable for both industrial and agricultural applications. Material used in the production of PVC-tufted pile carpets and mats, wall-to-wall carpets, and doormats. Support for hop plants and scaffolding erection for construction operations. Depending on the twist of the yam and the type of fibre used, a variety of characteristics suitable for various applications are available.

Fig. 3.1.8 Scaffolding rope

8. **Measure Tape:** One of the most crucial components is the tape measure. The tape measure comes in very handy when you require exact measures. Also, many feature belt clips that let it to be fastened to a belt or pocket opening, making it simple to carry. Also, many tape measures come in both standard and metric sizes, allowing you to choose the one that best suits your requirements.

   The magnetic grip model is recommended since it may be set down on any surface without risk of tipping over. The majority of usage only require ten to twelve feet, however depending on the task, one may require a longer one.

Fig. 3.1.9 Measuring Tape

9. **Pipe Cutter:** A proper pipe cutter resembles a C-clamp in appearance. Measuring the space where the scaffolding will be erected is the first step. Using the pipe cutter, cut the pipes to the correct length.

   Simply insert the pipe into the pipe cutter's "C" section, tighten, and turn to complete the cut. To preserve uniformity, it is typically ideal to cut all the required pipes at once. The remaining pipes can be marked for cutting once the first pipe has been appropriately cut.

Fig. 3.1.10 Pipe Cutter

10. **Scaffolding Tool Belt & Holders (Frogs):** A scaffolding tool belt is made to hold the tools required for building the scaffold and is balanced and low in weight. Because that the majority of the tools are highly adaptable, they can also be utilised as the main tool belt.

    One can increase or decrease the number of tools that can be held on the belt itself by using the holders, or "frogs," as they are commonly nicknamed. Several scaffold tool belt kits include extra frogs, allowing to decide which tools belong in the toolbox and which ones go on your belt.

Fig. 3.1.11 Scaffolding Tool Belt

3.1.7. Storing and stacking scaffolding materials

Scaffolding equipment should be stored and stacked properly to maintain its safety and readiness for usage. Inadequate equipment storage can lead to damage, a loss of equipment strength, and a loss of safe functioning. The following requirements must always be satisfied, whether the storage is in a rented facility, a scaffolder's warehouse, or on the job site:

- Arrange equipment storage to make it convenient to reach.
- Provide space for trucks, forklifts, and other handling machinery to move safely.
- Scaffold components should not be used to block access/egress points, emergency exits, safety signs and warnings, or emergency equipment.
- Provide scaffolding components enough support to keep them off the ground.
- Provide support between layers so that forklifts may handle the appropriate materials.
- Sort pieces of various sizes into distinct piles.
- Label part numbers prominently on each stack.
- Provide containers or boxes for minor parts.
- Separate and isolate any individual component parts that require repair. To prevent them from re-entering the general inventory, keep damaged components in a location that is clearly identified until they are fixed or discarded.
- Dispose of or destroy damaged parts using proper and authorised disposal techniques.
- Avoid piling up equipment to a point where it becomes unstable. Unstable stacks have the potential to collapse, resulting in catastrophic injury, fatality, and component part damage.
- Provide blocking so that tubing won't roll when handled. Unsupported tubing could hurt people by rolling upon them or getting damaged.
- Maintain clean and organised storage spaces.
- Avoid storing scaffold parts that are moist, especially planks. When putting away component components, always dry them.
- Planks are susceptible to mildew and rot if they are left damp for a long time (months). Any plank that exhibits mildew should be left to dry out before being evaluated for strength.
- Spacers should be placed between each layer of wet planks as they are put on level bearers far away from the ground. Place the stack somewhere dry and well-ventilated, and line up the spacers with the bearers. It is advised to use a minimum of three spacers per layer.
- Dry planks ought to be kept covered in storage.

Notes

Scan the QR code to watch the video

https://youtu.be/e_2ZDfWLtN4

Types of Scaffolds

https://youtu.be/5Vj-MosphpY

Scaffolding Components

Unit 3.2 Erect and maintain common customized system scaffold

Unit Objectives

By the end of this unit, participants will be able to:

- Explain process of preparation of base
- Describe the measures taken for protection of work and work area
- Define the criteria for selection of components, tools and equipment etc. as per the types of work
- Explain the standard procedure for erection of scaffold using in various customized scaffolds
- Discuss importance of providing supports to scaffolds
- Demonstrate preparation of base for customized scaffolds
- Demonstrate the erection of customized scaffolds up to specified height
- Demonstrate checks for alignment of scaffold as per instruction
- Demonstrate the process of providing support in customized scaffolds

3.2.1. Scaffolding Erection and Dismantle

The erection and disassembly of scaffolding remains a hazardous task, not just for those performing the work, but also for other workers and the general public. The measures outlined in this guidance must be considered by everyone engaged in such activities. It is intended not only for scaffolding sector workers, but also for clients, planning supervisors, and general contractors. Listed below are a number of important considerations you must make to ensure the safety of scaffolding activities.

Scaffolds should always be built under the guidance of a skilled professional. Despite the fact that scaffold systems differ between manufacturers, all scaffold systems must meet a few basic specifications. A professional engineer must design frame scaffolds above 15 m (50 ft.) in height and tube-and-clamp and systems scaffolds over 10 m (33 ft.). The scaffolds must be built in accordance with the design, according to supervisors'

Scaffold Licenses

Before a scaffold can be placed on a public motorway, a permit from the local authority is required. Typically, an additional licence is required to instal a protective fan. A licence may stipulate lighting or painting requirements for a scaffold, or the maximum height at which a fan may be installed. For further guidance you should contact your local highway authority.

Protection of the public

During scaffolding activities, the public must be separated from both the work area and a suitable buffer zone.

- Obtaining a temporary pavement or street closure whilst operations are carried out;
- Carrying out operations during "quiet" hours, i.e. early morning, late evening, or weekends;
- Incorporating fans, crash decks, and "tunnels" as early as possible into a scaffold;
- Erecting barriers and signs and diverting the public away from operations;
- Storing scaffold clips and other loose material safely on the scaffold; and
- Not raising or lowering the scaffold during

Also remember that disabled individuals require proper access along scaffold-covered sidewalks.

3.2.2. Scaffolding Erection

Scaffolding is frequently required for building and home maintenance. Set up scaffolding correctly to ensure your safety and the safety of those utilizing the equipment. A lapse in scaffolding erection could result in a serious accident. The use of scaffolding is an alternative to ladders. In comparison to a ladder, scaffolding provides a bigger working space and greater manoeuvrability. It provides a walking surface and a place to set your tools. This significantly reduces work hours.

Here is a summary of the processes necessary to construct scaffolding:

- **Establish the foundation.** The scaffolding should be constructed on flat, stable ground. Attach the scaffolding to base plates or mud sills for stability; if you are on an uneven surface, you may need to dig down to level the soil.
- **Level it.** Ensure the scaffolding is level by adjusting the screws. If the terrain is steeply sloping, you may need leg extensions.
- **Consider casting devices.** If you intend to move the scaffolding from one location to another, it should incorporate wheels. Ensure that the casters are locked before installing the item.
- **Guarantee good assembly.** The scaffolding ends must be constructed correctly. First, raise one end portion, then connect the upper cross brace. To attach the upper cross brace of the second end piece, you must support the end by lifting the far end of this brace. Finally, secure the ends of the cross braces to the bottom of the opposing end frame.
- **Place the planks.** Place the planks over the scaffold bar and secure them in place using the provided hardware.

- **Identify access.** Consider accessibility when constructing a scaffold. If ladders are used for access, ensure that they are suited for the exact scaffold you are using and do not offer any other safety risks.
- **Mount guardrails.** Due to the height of the equipment and the risk of falling, guardrails must be installed on all scaffolds. Additionally, you should think about fall prevention measures, such as tie-offs.
- **Observe it**. Inspect the scaffolding thoroughly to ensure that it is safe for use. Ensure that all scaffolding components are secure by reviewing the setup properly. After leaving and returning to the site, always verify the scaffolding to ensure that it is still safe.

3.2.3. Scaffold foundation

An appropriate foundation is necessary for a scaffold to be stable. Improper work procedures can cause a scaffold to become unstable, putting employees and bystanders at risk for fatalities or serious injuries.

Undertake the following to prepare the base if the scaffold is inside a structure.

- Remove any obstruction-causing debris, tools, or building supplies.
- Place sills or shoring beneath ageing timber floors.

Preparing the foundation for a scaffold on a building's exterior may involve:

- Swapping away mud and soft ground with gravel or crushed stone
- Compacting and levelling loose backfill.
- Utilizing mudsills, stabilising embankments, preventing erosion from rain or thawing, and providing protection against erosion

The mudsill must be continuous under at least two successive supports and be a minimum of 48 mm x 248 mm (2 in x 10 in) in size. The sill should, whenever possible, extend at least 30 cm (1 foot) beyond the scaffold foot at the ends and rest centrally on the mudsill. Mudsills may be positioned either across the width of the frames or along their length.

Under scaffold feet or under mudsills, blocking or packing materials like bricks, short pieces of wood, or other scrap materials shouldn't be used. Bricks or blocks may break if the scaffold is subjected to excessive loading. Blocking may move or shift as a result of vibration, leaving a scaffold leg unsupported. When high loads are applied to the scaffold in these circumstances, it may tumble.

When setting up a scaffold, inspect the area for the following things: the ground's condition; overhead wires; obstacles; variations in surface elevation; and tie-in locations and techniques.
Many of the issues that arise during erection can be avoided by thoroughly inspecting the area beforehand, which will enable erection to happen quickly, effectively, and safely.

3.2.4. Erecting a Frame Scaffold

The most prevalent kinds of scaffolds are frame scaffolds. Too frequently, they are built by inexperienced individuals who are unaware of the inherent risks. Erectors must be aware of any risks to not only themselves but also the scaffold's final user.

Accessories and Fittings

Often workers are hesitant to attach all the connections, parts, and accessories needed for a fully constructed frame scaffold. Because parts are regularly misplaced or otherwise unavailable at the site, this bad practise persists. Maybe it's because of haste, a lack of experience, or carelessness.

Always utilise adjustable screw jacks with base plates. They enable modest changes to maintain the scaffold's level and plumb. Often, base plates feature holes so that you can fasten them to mudsills. This is best practise, and it ought to be carried out as soon as the first tier is constructed and base plates are centred on the sills.

On each side of every frame, you must brace in the vertical plane. Starting with the first tier of frames, the joints of every third tier should be braced in the horizontal direction. The place where the scaffold is linked to the building should line up with the horizontal bracing. To maintain scaffold stability and full weight carrying capacity, horizontal bracing is required. Before fastening foundation plates to mudsills, the scaffold can be squared up with the use of horizontal bracing on the first layer.

To join scaffold frames vertically, coupling mechanisms are offered by every scaffold manufacturer.

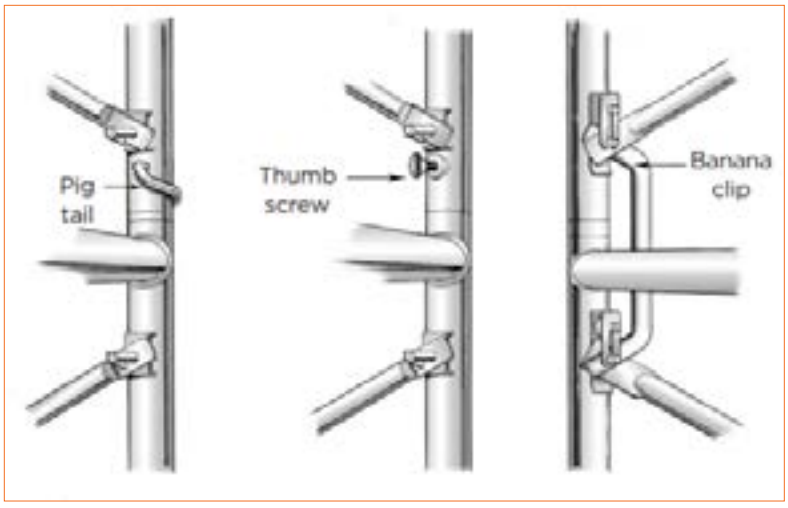

Fig 3.2.1 Coupling Devices

If wheels or castors are utilised, they must be braked and firmly fastened to the scaffold. Many catastrophic accidents and fatalities with rolling scaffolds have been caused by improperly attached wheels or castors. Brakes that are conveniently accessible and well-maintained must be present on wheels or castors. Guardrails should always be present on scaffolds.

Braces

The braces for each tower span must then be attached once the frames have been fitted with the adjustable base plates. The braces should be simple to put into place. If force is necessary, either the frames are out of plumb or out of alignment, or the braces are bent or damaged.

At either end, secure braces. Self-locking mechanisms must be checked by the erection team to make sure they are in place and working properly. Some of these devices may become inoperable due to rust or minor damage, in which case force is needed to hold them in place. To avoid this scenario from occurring, keep moving parts in good condition.

Platform Erection

When attaching platform components to a scaffold tier, make sure that all of the parts and fittings are in position and secure.

Workers should use the platform parts or planks from the previous tier when moving on to the next one, leaving one platform section or two planks behind. While more material is needed, construction is quicker since workers have platforms to stand on while setting up or taking down the platform above. At heights greater than 3 metres (10 ft.), all personnel engaged in the construction or dismantling of scaffolds must be protected by a guardrail or another form of fall protection.

Ladders

Ladders should be installed as each tier is built in cases where the frames lack ladder rungs. Scaffold-related accidents often involve workers who are ascending or descending the scaffold. By providing suitable ladders, such injuries can be avoided. If MOL inspectors observe workers scaling the end frames to reach a scaffold platform, they will typically issue orders. For more information, refer to the previous section on ladders under scaffold components.

Guardrails

As the scaffold is being constructed, guardrails must be fitted at each working level as well as at the top level. No matter the height of the scaffold, this is advised. Guardrails are not necessary until scaffolds are 2.4 m (8 ft.) high, however falls from lower scaffolds nevertheless cause a significant number of serious injuries and even fatalities.

In addition, regardless of height, fall protection is necessary whenever workers could hit something dangerous.

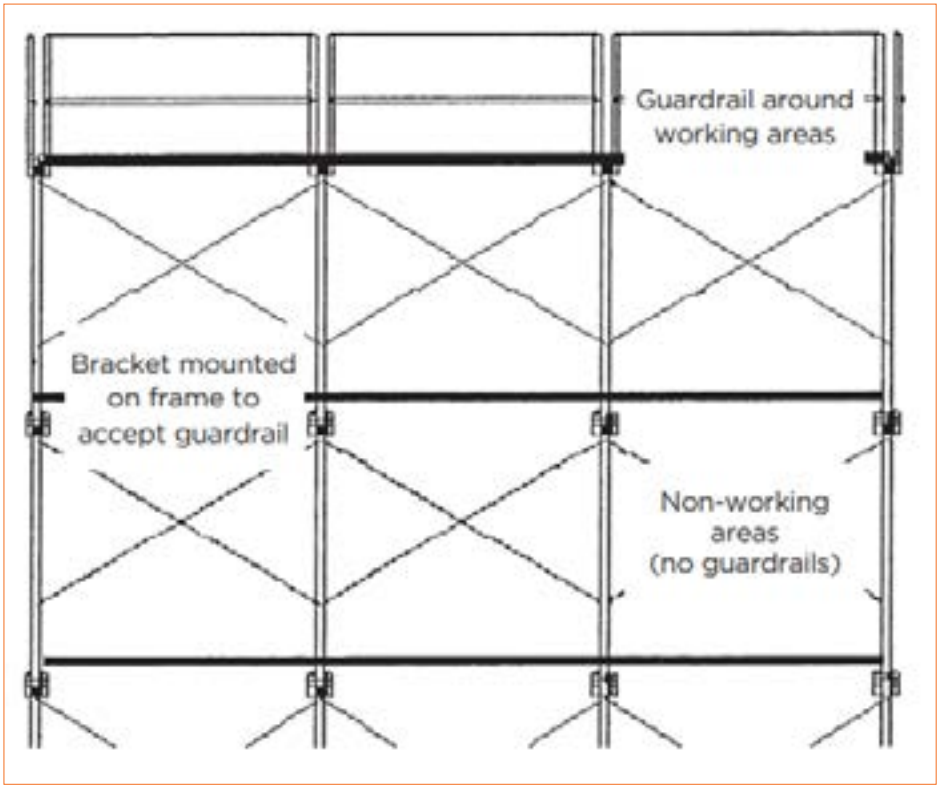

Fig 3.2.2 Temporary Guardrails

3.2.5. Erecting Tube-and-Clamp Scaffolds

The majority of general guidelines for frame scaffolding also apply to tube-and-clamp scaffolding. For both versions, the specifications for mudsills, platforms, and guardrails are identical.

The most significant distinction between the two is the additional level of expertise and knowledge required to create tube-and-clamp scaffolds in a safe and effective manner. An inexperienced or unskilled team shouldn't construct tube-and-clamp scaffolds. Figure 3.2.3 defines the fundamental terms.

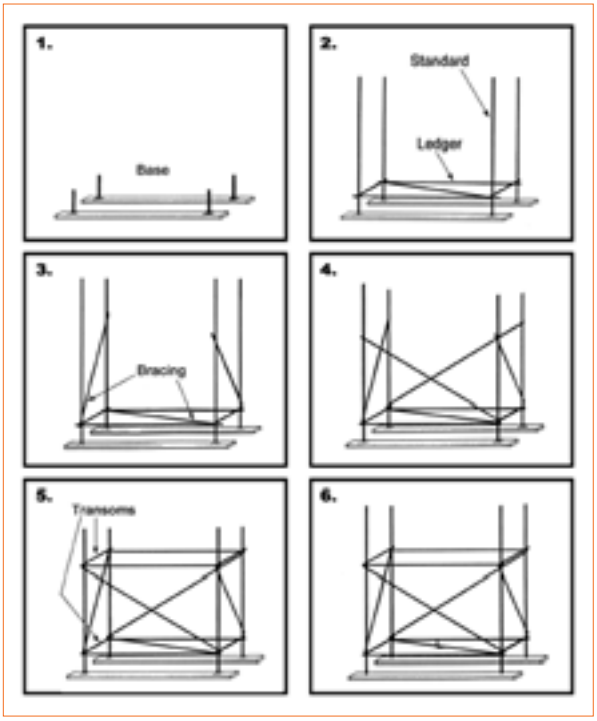

Fig 3.2.3 Erection of Tube and Clamp Scaffolds

Normative Prerequisites

Like frame scaffolds, tube-and-clamp scaffolds are built plumb and level, but their construction method is very different. Over the base plates, the scaffold must begin with a set of ledgers and transoms. This is required to keep the base plates in the right place. As construction progresses, each vertical and horizontal member needs to be levelled with a spirit level.

Components and Materials

Schedule 40, 1.9 inch OD (1 1 /2 ID), aluminium pipe made of either 6061 or 6063 alloys is the tubing typically utilised for tube-and-clamp scaffolding.

The majority of clamps are composed of steel and come in a range of designs. Clamps can be secured using bolts, wedges, or other tools, depending on the manufacturer. The categories listed below are employed.

- **Right-Angle Clamp:** A clamp for joining tubes at a right angle is a right-angle clamp. They keep the structure's right-angled orientation, which gives it stiffness.
- **End-to-End Clamp:** a clamp that is applied from the outside to join two tubes end to end.
- **Swivel Clamp:** When right-angle clamps cannot be utilised, this clamp is used to join two tubes. Bracing is typically connected.
- **Parallel Clamp:** This clamp is used to lap connect two tubes. Short guardrail posts can be attached to frame scaffold standards or legs using this.
- **Concrete Tie Clamp:** This clamp fastens a tube to concrete or other surfaces with the use of a bolt or concrete anchor.

Standard Spacing of Standards

The scaffold's load-carrying requirements determine the spacing of the standards. As much as is practical, bay and elevation spacing on tube and clamp scaffolding should be around 2 m (6 ft. 6 in) long and high. As a result, the front sway bracing can be positioned at a 45-degree angle to the horizontal. Also, it makes it easier to employ planks with an acceptable overhang of 5 m (16 ft.).

This platforms' width can change, although it is typically 1 m. (3 ft.). This distance enables the aluminium tubing mentioned earlier to adequately support typical building loads. The ability to easily modify the platform height to the ideal level for the task being done is a benefit of tube-and-clamp scaffolding.

Ledgers and Transoms

Right-angle clamps should be used to secure ledgers to standards. These clamps keep the angle between the members tight at 90 degrees.

Transoms must be positioned above ledgers, and both must be kept horizontal by levelling with a spirit level. Right-angle clamps can be used to attach transoms to standards or ledgers.

Standards and Ledgers Joints

End-to-end clamps should be used to join standards and ledgers. As close to the node sites as the clamp arrangements will allow, these joints should be placed. In order to offer rigidity, joints between vertically neighbouring ledgers shouldn't happen in the same bay but rather should be spaced out.
The junction of the connections from the ledger to the standard, the transom to the standard, and the bracing to the standard is known as a node point.

When the scaffold will be carrying significant weights, intermediary transoms should be constructed. These can also be used to prevent lapping planks and the associated tripping hazard.

Tie-Ins

While using tube and clamp scaffolding, tie-ins are necessary. They should be placed every third standard horizontally and every second node vertically. To add rigidity, the tie-in tube should be attached to both standards and both ledgers close to the standard. Right-angle clamps should be used for connections. Tie-ins ought to be able to bear both compression (push) and tension (pull) pressures.

Bracing

Swivel clamps are used to connect internal bracing from standard to standard. It ought to be clamped as closely as possible to the node.

Every third standard should typically have internal bracing. Tie-in points should be present at the place. As the construction of the tube-and-clamp scaffolding advances, bracing should also be added. Install face sway bracing all the way up the scaffold's height. It could be contained within a single bay or span numerous bays.

If bracing is used in single bays, it should be at least every fourth bay longitudinally and in the end bays. If the bracing is wider than four bays, it becomes challenging to place it near enough to the node locations in practise.

3.2.6. Erecting Systems Scaffolds

System scaffold erection is quite similar to tube-and-clamp scaffold erection. The specifications for guardrails, mudsills, and platforms are the same as those for being level and plumb when constructed.

The mechanism used to join individual parts together and the fact that each member is a defined length are the key differences. Any systems scaffolds beyond 10 m (33 ft.) must be designed by a professional engineer, just like tube-and-clamp scaffolds.

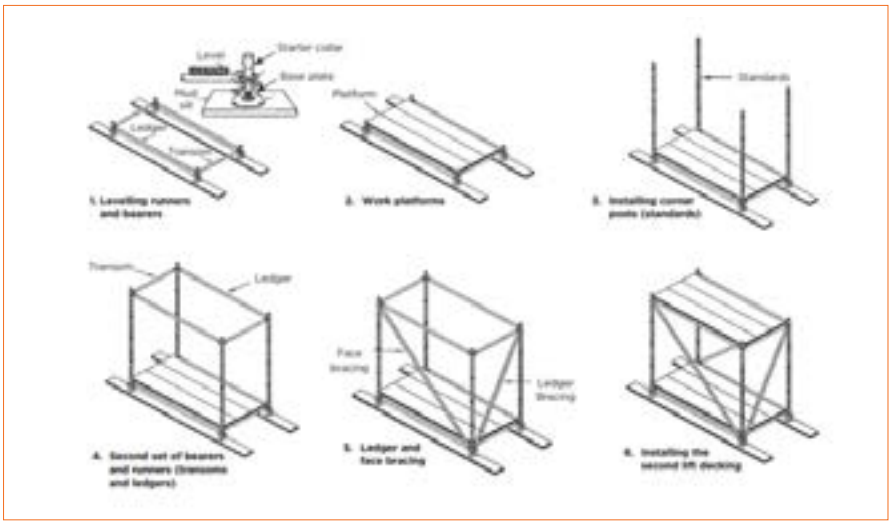

Fig. 3.2.4 Erecting sequence of a Typical System Scaffolding

Erection Procedure

- Like with other types of scaffolding, the foundation for systems scaffolds should be prepared by utilising mudsills, base plates, and adjustable screw jacks to ensure a solid, level base.
- The base plates should be positioned where you believe they should be. Starter collars are advised because they make it possible to set up scaffolds squarely and level.
- The starting collars should support the first level of transoms and ledgers, which should then be levelled with the use of screw jacks. One should tighten the connections and nail the foundation plates to the mudsills once the scaffold is square and level.

- Install the standards for the subsequent lift at this time by erecting an erection platform. The deck is now put in place, along with the second level ledgers and transoms.
- All system scaffolds must have ledger bracing installed at the ends and periodically as specified by the manufacturers. Each brace should be connected to the standard's connection point and be the proper length for the span it is intended to support.
- Installing face or sway bracing must be done in accordance with the manufacturer's recommendations. Once more, connection sites are predetermined on the standards, and the braces are available in a range of lengths to accommodate the span of the scaffold being built. Typically, every third bay has sway braces.

Tie-Ins

The 3-to-1 guideline must be followed while tying in Tie-Ins Systems scaffolds to structures. While some manufacturers employ a tube-and-clamp method to attach to the structure, others use unique adjustable ties that hook into the standards. The anchors fastened to the building are identical to those used with frame or tube-and-clamp scaffolds.

Guardrails

Guardrails are often erected at each working level. These guardrail parts are shorter than the ledgers and are available in modular lengths. They are connected directly to the standards' connection points. Several manufacturers have developed advanced guardrail systems that can be installed for a level above the erector and provide fall protection for the worker accessing the next level.

A temporary guardrail in the shape of a "T" is joined to the long guardrails on the level. When attached, it extends past the deck over the necessary amount to provide a guardrail. The subsequent level of standards, ledgers, and transoms can then be installed while the erector is free to operate without being restrained.

3.2.7. Safety Checks

1. Vertical Safety Check: Checking verticality would be required at various stages of building construction, such as when constructing vertical column formwork and transferring levels up consecutive floors of multi-story constructions. Several ways for controlling or inspecting verticality work in building construction are discussed.

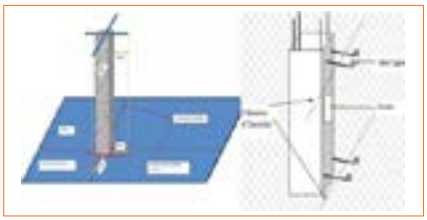

Fig. 3.2.5 Vertical Scaffolding Check

Methods used to check or control verticality works include:

a. Plumb-bob technique
b. Spirit level
c. Theodolite
d. Optical plummet

Fig. 3.2.6 Plum Bob Technique

a. Plumb-Bob Technique

As depicted in the illustration below, a plum-bob consists of a weight with a pointy tip attached to the end of a string. The heavy object will hang under the force of gravity and provide an exact vertical line, known as a plumb line.

This method is used for verifying or controlling the vertical alignment of structural elements, particularly inside, such as lift shafts. In addition, it controls the verticality of the foundation, walls, and columns.

The plumb line or vertical line of a plumb-bob will lose its accuracy and precision when subjected to wind force. Small to moderate lateral movement of the plumb-bob can be effectively minimized by soaking it in oil or water. If the height of the structural member is high, it is conceivable to replace the string with a long wire, but substantial precautions must be taken to avoid endangering the workers below.

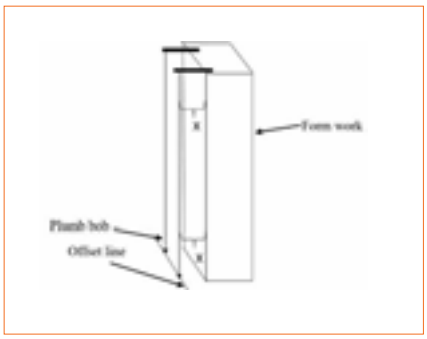

Fig. 3.2.7 Checking Verticality of Columns

b. Spirit Level Method

This device is suitable for managing the verticality of small-scale construction projects, such as examining door frames and formwork. If a spirit level is used for approximate inspections, then a more precise technique must be used to evaluate the verticality.

Fig. 3.2.8 Spirit Level

c. Theodolite Method

The theodolite is an extremely potent equipment that may be used to check the verticality of construction projects with high precision and accuracy. It is appropriate for verifying or managing the verticality of towers as depicted in Figure 4.1.9, walls, foundations, and columns as depicted in Figure 4.1.10, particularly a large number of columns along a single grid line. Using a Theodolite in conjunction with a tape, it is possible to measure the slope of the member's out-of-plumb line. The process for verifying column verticality comprises:

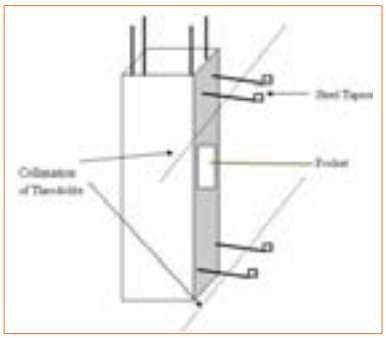

Fig. 3.2.9 Checking Verticality Using Theodolite

Install the digital Theodolite so that it is positioned on a peg that is 500 mm from the column grid.

After Theodolite has been precisely positioned, the laser beam will be activated and focused on the steel tape that is attached to the formwork.

Put the steel tape's reading via the telescope.

Take the readings of two spots at the same level on both the upper and lower formwork levels. By taking two measurements at the same level, any surface curvature can be determined. The figure below illustrates these steps.

d. Optical Plummet Method

It is a device that can look directly up or directly down. In comparison to previous methods utilized for managing verticality, the optical plummet's automatic compensator substantially improves its accuracy.

Fig. 3.2.10 Optical Plummet

2. Stability Check: Under each foot's contact with the ground, stabilise the scaffolding with solid, flat wood planks. This will prevent your scaffolding from becoming uneven and sinking into muck. Add weight and bracing to prevent the device from toppling.

Rule of Three to One

Unless the scaffold is one of the following, the height to least lateral dimension ratio cannot exceed 3:1.

- Linked to a structure, as described in the Tie-in Requirements section.
- Fitted with appropriate guy wires
- Provided with outrigger stabilisers to preserve the 3 to 1 ratio.

Notes

Scan the QR code to watch the video

https://youtu.be/OKawvyUhUkA

Scaffolding Erection and Dismantle

https://youtu.be/0LS2COMYEk4

Scaffolding Erection

https://youtu.be/oiglnKsQcoQ

Erecting Systems Scaffolds

https://youtu.be/AoDWOZE8Wb4

Safety Checks

Unit 3.3 Dismantle common customized system scaffold

Unit Objectives

By the end of this unit, participants will be able to:

- Demonstrate the dismantling of customized scaffolds
- Describe the measures taken for protection of work and work area

3.3.1. Dismantling the Scaffold

Once the scaffold has passed all safety inspections, then can begin disassembling it. Again, one should continue methodically:

Step 1: Make space for the disassembled scaffolding components.

Create a nearby storage area for the disassembled scaffolding components. During disassembly, individual scaffold components should be taken off the scaffold and set away for subsequent inspection. In addition, there must be an access route for the vehicle that will transfer the scaffolding materials away from the construction site.

Step 2: Put safety equipment

Wear the appropriate protective clothes. This comprises PPE, such as safety shoes, a helmet, and gloves, as well as any other safety equipment necessary by the project.

Step 3: Remove scaffolding components from the top to the bottom

Logic dictates that disassembly should occur in the reverse sequence of assembly, from top to bottom. Before disassembling the scaffold decks, remove the tubes and safety railings first. During disassembly, scaffolding components should not be stored on the scaffold, but rather transferred immediately to the ground. This can be accomplished by reaching down to a colleague or by carefully lowering using a rope system or similar device.

Step 4. Remove scaffolding anchors

Stability must also be maintained at all times during scaffold disassembly. Therefore, remove the anchors only after disassembling the complete platform.

Step 5: Check the scaffolding components

After disassembling all scaffolding components, properly inspect them. Defective scaffolding components may cause injury, so any components that cannot be fixed must be set aside for disposal. All undamaged or reparable scaffolding components must be stored properly for transfer off-site.

3.3.2. Safety Check before Dismantling

Safety must always come first in scaffolding and the construction business. Because disassembling a scaffold is just as tough as assembling one. Therefore, one must first devise a plan for disassembling your scaffold. Before dismantling a scaffold, one should always begin by doing a comprehensive inspection. One may continue as follows:

One may continue as follows: Check the stability and statics of the scaffolding. All scaffolding components should continue to be firmly attached to one another. If individual components have been removed or badly damaged throughout the scaffold's service life, they must be replaced for safe dismantlement.

Step 2: Check whether the scaffolding decks are still firmly in place.

Step 3: Verify the stability of all anchors and fasteners on the scaffold.

Step 4: Check the type of fall protection required during disassembly and install it.

Step 5: Ensure that no unsecured building materials or tools remain on the scaffolding. In the worst-case scenario, these could fall during disassembly and injure those below.

All of these stages are fundamental to a proper scaffold inspection.

3.3.3. Hazards involved in Scaffolding

The following are the primary risks involved when using scaffolds:

1. Erecting and Dismantling

Erecting and dismantling scaffolds are involved in 15–20% of scaffold-related injuries. The most frequent issue is a worker not having a suitable working platform to employ when erecting the scaffold's subsequent lift. It is not advised to start with just one or two planks.

As the assembly advances, it's crucial to install all necessary parts, like tie-ins. The scaffold becomes less sturdy if this isn't done, and even if it doesn't tumble over, it could swing or shift enough to knock someone off the platform. This occurs more frequently when guardrails are absent and platforms are just one or two planks wide, which is frequently the situation during assembly and disassembly.

2. The Climbing Up and Down

Workers who are climbing up and down scaffolds account for 15% of all scaffold-related injuries. Many injuries and fatalities have been caused by people climbing up and down scaffold frames and bracing. Provide workers with enough ladders or scaffold stairs to use in order to avoid this. Also, employees need to climb safely (3-point contact).

3. Breaking or Planks Sliding Off

Plank issues are a common cause of scaffold injuries.

Scaffold planks can readily fall off if they are uncleated or otherwise left unstable. If scaffold boards are overloaded or in bad condition, they may potentially shatter. Thus, it's crucial to use the right lumber grades and to check the planks before erecting them to make sure there are no weak spots, degradation, or cracks.

Insufficient or excessive overhang of planks at their support is also a common problem. When a worker stands on the overhanging piece, a plank with excessive overhang may tip up. The main factor contributing to planks coming off is insufficient overhang.

4. Overloading or improper loading

Overloading results in severe plank deflection, which can damage and even shatter the planks.

Overloading is especially prevalent in the construction industry, where material skids can weigh more than 1,500 kg (3,000 lb.). Placing masonry cubes immediately above the scaffold frame, where there is more support, is preferable wherever it is practical (O. Reg. 213/91, s. 136(1)). A scaffold can go over if heavy materials are left hanging over the platform. This can also create an imbalance.

5. Platforms are not completely decked

Injuries caused by incompletely planked scaffolds can occur both during the construction and dismantling processes as well as during regular scaffold use. All scaffold platforms must comply with regulations, which state that they must be at least 460 mm (18 in) broad and fully decked if they are higher than 2.4 m (8 ft.).

6. Platforms with no Guardrails

Construction platforms without guardrails pose a severe safety risk. Guardrails are an essential fall prevention measure for both low and high platforms. Platforms under 3 m (10 ft.) in height account for more than one-third of scaffold fall accidents. Hence, guardrails are advised for all scaffold platforms over 1.5 m (5 ft.) in height when in regular use. A top rail, a midrail, and a toeboard should make up the guardrails on all working platforms.

7. Not installing all necessary components

A significant safety issue arises from the improper usage of all the necessary scaffolding components. Scaffolds that are merely a few frames high encourage workers to take short cuts. They usually neglect to install foundation plates, braces, enough tie-ins, and suitable securing tools like "pig tails" or "banana clips" at the pins of frame scaffolds. To ensure the safety of the scaffold, those erecting it must have all the materials on hand and must use them. Furthermore, when the scaffold is being built, employees should install these components.

8. Electrical Interaction with Above-Roof Wires

Even though scaffolds seldom collide with overhead power lines, when they do, it nearly invariably ends in fatalities. Moving scaffolds without keeping safe distances from overhead powerlines is a serious

issue. Be sure there are no overhead wires in the immediate area before attempting to move rolling scaffolds in an open, outdoor area. In some circumstances, partial deconstruction may be required to guarantee that the scaffold will make the requisite safe clearances from above powerlines. Forklifting or any other mechanical hoisting equipment is not recommended close to powerlines and requires careful preparation.

There have been numerous electrical connections as a result of forklift transporting already-erected scaffolds, notably in residential building. Employees on the platform must also take precautions to prevent electrical contact when handling supplies or tools.

9. Rolling scaffolds are moved with workers on platform.

It can be unsafe to move mobile scaffolds while employees are on the platform. Each worker must be secured with a full body harness and lanyard when it is impracticable for them to climb down and the scaffold is higher than 3 m (10 ft.). Lifelines must be fastened to an alternative anchor point to the scaffold that is adequate. Scaffolds have turned over while being relocated because of holes, depressions, curbs, and other features. If the platform is higher than a specific height, moving a scaffold with personnel on it may be illegal in some areas.

Scan the QR code to watch the video

https://youtu.be/1gaFbGOazMg

Dismantling the Scaffold

https://youtu.be/AoDWOZE8Wb4

Hazards involved in Scaffolding

Exercise

1. Explain the different types of scaffolds.
2. List the different types of tools used in erection and dismantling a scaffolding.
3. Describe the process of erecting a scaffold.
4. Describe the process of dismantling a scaffold.
5. List the hazards involved in erecting and dismantling a scaffold.

4. Work Effectively in a Team

Unit 4.1- Work effectively in a team

(CON/N8001)

Key Learning Outcomes

By the end of this module, participants will be able to:

- Demonstrate effective communication with co-workers, superiors and sub-ordinates across different teams
- Provide support to co-workers, superiors and sub-ordinates within the team and across interfacing teams to ensure effective execution of assigned task.

Unit 4.1 Effective Interaction and Communication

Unit Objectives

By the end of this unit, participants will be able to:

- Demonstrate effective communication skills while interacting with co-workers, trade seniors and others during the assigned task.
- Interpret work sketches, formats, permits, protocols, checklists and other work-related requirements which are to be conveyed to other team members
- Demonstrate effective reporting to seniors as per applicable organisational norms.
- Explain effects and benefits of timely actions relevant to system scaffolding works with examples
- Explain importance of team work and its effects relevant to system scaffolding works with examples
- Demonstrate team work skills during assigned task.

4.1.1. Effective Communication

Effective communication is the process of sending and receiving messages from sender to receiver properly and successfully. The information is passed by signs and signals, speaking, writing or using some other medium and means. The objectives of effective communication are:

1. Sending, receiving and understanding the message or information.
2. Development of Interpersonal Skills.
3. To express effectively & with maximum efficiency.

Effective communication requires one to follow basic principles of communication, i.e., 7Cs:

- Clear: Be assertive about what needs to be communicated, whether verbally or in writing
- Concise: Use simple words and say only what's needed
- Concrete: Use exact words, phrases, Use facts and figures
- Correct: Use correct spellings, language and grammar
- Coherent: Words should make sense and should be related to the main topic
- Complete: A message should have all the needed information
- Courteous: Be respectful, friendly and honest

Communication Process

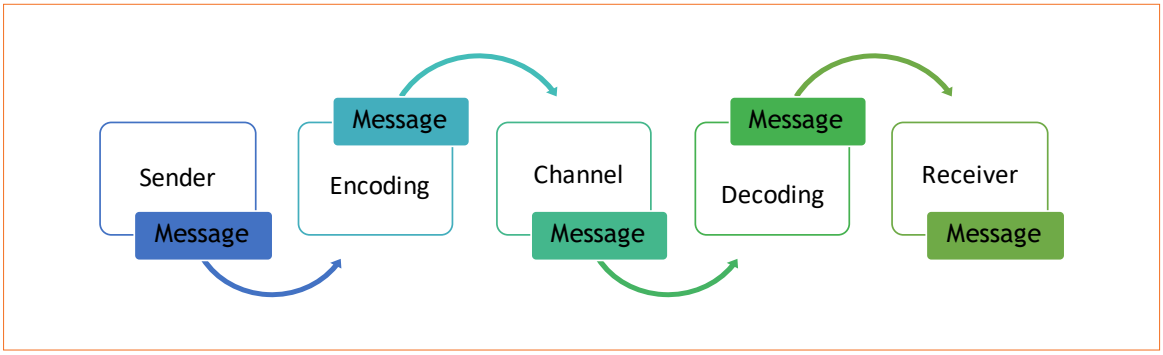

Fig4.1.1 Effective Communication Process

- Sender: The person or entity starting the communication.
- Message: The information that the sender wishes to share.
- Encoding: Choosing the medium to send a message.
- Channel: The medium used to send a message.
- Receiver: The person or entity to whom the message is sent.
- Decoding: Understanding the message received.
- Feedback: The receiver's response to the message.

4.1.2. Workplace Communication

Every workplace organisation requires communication for day-to-day business, regardless of size, location, goals, etc. It forms a bridge between people to exchange ideas, inform, express their feelings, influence others, etc. Communication is required to communicate within the organisation with managers and employees, etc. and outside with suppliers, buyers, etc.

Effective Communication with Stakeholders

The key factors to establishing effective communication in the construction industry are:

1. Establish a Communication Chain of Command

Construction projects need a communication chain. The contract documents usually require the owner and general contractor to communicate through the architect.

The architect communicates with consultants and the general contractor with suppliers and subcontractors. The general contractor usually contacts the project superintendent.

Contract documents—drawings, specifications, change order forms, and requests for information—form the basis for construction communication. Any direct communication not in the contract documents must be authorised, and any scope or schedule modifications must be documented and reported.

2. Select an Appropriate Communication Method

We communicate vocally and nonverbally daily, and construction communication is no different. We text, talk on the phone and in person, send emails, and some of us still use fax machines inexplicably in this digital era. We communicate on the building site with signs, drawings, hand gestures, and meetings. We write daily reports, take photographs, generate information requests (RFIs), and examine modification orders.

There are benefits and drawbacks to each way of communication. Selecting the appropriate mode of communication can facilitate and expedite the transmission of information.

3. Be an Active Listener

One should be an active listener when engaging in oral communication, whether in person or by phone. At best, it is passive listening to sit there and absorb the information like a digital recorder. Try to comprehend what the speaker is trying to convey from their perspective.

Take notes on significant points, rather than transcribing every word they say, and jot down information that may require clarification. Maintain eye contact and use nonverbal cues such as head nods to demonstrate attentive listening.

4. Prevent Confusion, Be Clear and Concise

When communicating in the construction industry, you want your message to be understood the first time you convey it. Avoid jargon and unfamiliar phrases when interacting with others. Your communication should be concise and direct. Keep it as brief and clear as possible.

Focus on one project at a time if you are working on multiple projects with the same owner or architect to avoid misunderstanding. The real difficulty lies in attempting to be as descriptive as possible while using as few words as possible.

It takes practice to be concise yet comprehensive in your construction communications. Before sending any written communication, proofread it to determine if it may be shortened without affecting its meaning or omitting vital details.

5. Keep Written Communication Always Professional

Avoid using profanity and allowing your emotions to influence your message. If your feelings are running high, wait 24 hours before sending the email so that you can examine and make any necessary modifications. If a quick answer is required, read the message aloud or have another person review it for a second opinion.
Separate huge data pieces into smaller paragraphs. People tend to scan rather than read emails; thus, dividing the content into smaller bits facilitates processing. Use numbered or bulleted lists when delivering numerous details or posing innumerable questions.

6. Stick to the Facts

One should solely care about presenting or obtaining facts. In all communications, do not overcomplicate or provide irrelevant details. Keep the personal ideas and feelings about a project to yourself unless asked.

However, you must offer your professional thoughts on a project when you believe they could contribute to its practical completion. Your company's expertise contributed to its selection for the project, so don't be shy.

- Communicate effectively with the plant operator; Lower all ground engagement tools and/or implements to the ground.
- Disengage the plant controls so that they cannot be accidentally activated by the operator or by any other means;
- Visibly remove their hands from the controls of the powered mobile plant; and cease all movement of the plant.

4.1.3. Adverse Effects of Poor Communication

There is poor workplace communication when there is a disconnect between what is said and what is heard, whether between co-workers or between an employee and management. Specifically, there is a lack of mutual understanding between two parties when the recipient of your communication misunderstands it.

The following issues are faced due to poor communication:

Creating Confusion

In building, a lack of communication is problematic. Miscommunications can also have a negative effect on a project by causing misunderstandings among significant stakeholders, construction professionals, and field personnel. Inconsistent reporting, incomplete reporting, inaccurate reporting, and delayed reporting can all contribute to errors that result in project delays and cost overruns on the construction site and the office.

Clear and straightforward messages prevent confusion. Keep messages brief, concise, and to the point.

Unnecessary Delays

Poor communication is a primary cause of project delays in the construction sector. It can manifest in various ways, including delays in the flow of information, communication directed to the wrong person or location, and confusing communication that leads to misunderstanding or incorrect interpretation. Any of these inefficient communication elements can result in errors and cause delays. Ordering unsuitable material, omitting a step in the construction process, or misallocating labour can all result in project delays.

Budget/Cost Overruns

According to the Project Management Institute (PMI), inefficient communications and improper time management of project communications account for more than half of all project budget risks. Poor or erroneous communication frequently results in greater expenditures. Adding a zero to a significant number can wreak havoc on a budget.

Injuries and Safety Issues

Poor safety communication is frequently attributable to three frequent causes:

- Workers lack familiarity with the safety training vocabulary. This is particularly true for trainees who are fresh to safety training. They can disconnect more quickly at this moment.
- Workers are scared to speak out when they find a safety hazard. They may fear judgement if they alert a colleague or supervisor to a potential danger. It is simpler to avoid risk.

- Workers frequently regard safety communication as unfavourable. Typically, only negative situations are discussed or emphasised, while the positive aspects of their behaviour are neglected.

Issues with Stakeholders

Multiple parties are involved in every construction project, including owners, designers, investors, general contractors, project managers, subcontractors, and labourers. Effective and thorough communication among a project's stakeholders is essential to its success. It can lead to increased project expenses, delays, and stakeholder disputes. Poor project data and miscommunications between project stakeholders account for nearly 48% of all project rework.

4.1.4. Teamwork at Workplace

Teamwork is when people of an organisation collaborate to achieve a common objective or set of objectives. In the modern workplace, teamwork can take place in-person or (increasingly) online.

It is important to note that modern teams are vastly different from those of the past. Today's teams, for instance, are more varied and dynamic, with specialised skill sets that present new problems and opportunities. Consequently, any team-based initiative can also serve as an opportunity for personal and professional development.

As technology continues to dominate the workplace, digital literacy, or the ability to use information and communication technologies, has become increasingly vital in team settings.

Advantages of Teamwork

There is no stronger tool in a business' armoury than a strong staff. Effective teams can increase efficiency by tackling more complex tasks (think "two heads are better than one"), improve communication by fostering open discussion and cooperation among team members, maximise output by leveraging each team member's strengths, provide opportunities for personal growth, and serve as a support mechanism for staff.

Unsurprisingly, cooperation in the workplace has also been demonstrated to boost invention and creativity by allowing team members to contribute their own unique perspectives. Effective cooperation supports organisational growth and improves performance and success by capitalising on the unique talents and characteristics of each employee.

4.1.5. 5 C's of Teamwork

It is crucial for organisations and corporations to continuously seek ways to increase their productivity and competitiveness. It has been discovered how to make work teams more unified and effective. In other words, work as a team. For this reason, a great number of specialists have sought out the most efficient method for fostering teamwork.

Tom Peters, who is regarded by many as the "father" of modern management, investigated the variables necessary for teams to achieve high performance. His research established the five C's of teamwork, which are essential for achieving high performance.

5 C's of Teamwork				
Co-operation	**Communication**	**Confidentiality**	**Competence**	**Courage**

Co-operation

Without cooperation between team members, no group will survive. Cooperation is intimately linked to effective communication and self-assurance. Better communication and a transparent and healthy work environment necessitate some degree of clarity and trust.

Compromise

Work relationships are not exempt from the necessity of reaching compromises on particular issues. If our peers' or managers' argument is valid and can contribute to greater performance, we may be required to concur. It is acceptable that not everyone can be on the same page at all times. To manage such circumstances, we must examine the situation and consider potential outcomes.

Communication

Considered vital for organising the individual and group efforts of the team. Communication is essential for conflict resolution and problem-solving, and companies must support healthy communication within and between teams. Communication must be open, honest, and timely so that every team member knows what to do and how to do it.

Confidence

Team members should have confidence in their skills. The leader must provide the team with a clear and simple explanation of the project, each member's responsibilities, and the final objective. It is essential to remember that confidence does not develop in the blink of an eye. It must be constructed step by step.

Commitment

The demands and interests of the team take precedence above individual concerns. Every action should contribute to the overall corporate objective.

4.1.6. Enhancing Teamwork in the Workplace

Working in a team can be complicated due to the fact that we are all unique individuals with varying mental states. Improving teamwork relies heavily on the role of the team's leader. Here are some recommendations that can assist them in achieving greater teamwork:

1. Concentrate more on "us" than "me"

A minor step is to begin speaking in the plural, so that all members feel as though they are a part of the effort. The greater our involvement, the harder we work to obtain the finest results.

2. Communicate Explicitly

Communication is the fundamental prerequisite. We must create an atmosphere in which team members are free to share their thoughts. It is advisable to make an effort to prevent such misunderstandings.

3. Delegate and believe

When working in a team, each assignment symbolises a problem that can be readily overcome via teamwork. Team leaders should be aware of the abilities and qualities of their team members and assign them jobs where they may demonstrate their value. For this, they must feel at ease while working and have confidence that their bosses have faith in them.

4. Establish shared aims and objectives

It is crucial to establish a unified business objective and effectively communicate it to team members.

5. Recognize and honour the achievements of others.

This attitude strengthens the team's trust and teamwork, which will inspire them to achieve the following objectives.

6. Conquer a conflict with success

Workplace conflicts are prevalent, and people with conflict management abilities are in high demand. Learn this talent if you still lack it.

7. Build a diverse group

People with varied origins, personalities, and experiences can be a source of innovative ideas. Through intelligent reading, we will recognise that we have the opportunity to maximise each individual's qualities.

8. Believe in Team Building

It's been said that teams that have fun remain together, thus establishing personal relationships in the workplace is a fantastic way to boost teamwork.

4.1.7. Importance of Teamwork in

Teamwork is crucial when it comes to scaffolding erection and dismantle. Scaffolding is a temporary structure used to support workers and materials during construction or maintenance work. It is a complex system that requires skilled and knowledgeable workers to erect and dismantle safely.

Here are some reasons why teamwork is important in scaffolding erection and dismantle:

- **Safety:** Safety is the primary concern when it comes to scaffolding. Working at heights can be dangerous, and accidents can lead to serious injuries or even death. A team working together can help ensure that all safety measures are in place, and everyone is working safely. They can also keep an eye on each other to ensure that they are wearing proper safety gear and following all safety protocols.
- **Efficiency:** Scaffolding erection and dismantle require coordination and planning. A team that works well together can efficiently plan and execute the tasks involved in scaffolding erection and dismantle. This can help save time and reduce downtime, allowing the project to move forward at a faster pace.
- **Communication:** Effective communication is critical when it comes to scaffolding erection and dismantle. A team that communicates well can quickly identify and address any issues that arise. This can help prevent delays and ensure that the project runs smoothly.
- **Experience:** Scaffolding erection and dismantle require specialized skills and knowledge. A team that has experience working together can draw on each other's expertise and knowledge to ensure that the job is done right. This can help ensure that the scaffolding is erected and dismantled safely and efficiently.

4.1.8. Time Management

Time management is not about working harder; rather, it is about working smarter so that employees do not overburden themselves and create unnecessary strain. By effectively managing their time, employees will meet deadlines, increase their effectiveness, become more productive, and produce superior work.

By effectively managing their time, employees will meet deadlines, increase their effectiveness, become more productive, and produce superior work. They will also have a higher degree of job satisfaction because they will experience less stress, which will help them advance in their careers and reduce your company's staff turnover.

The benefits of time management skills to both for the person and the company are:

1. **Enhanced productivity and performance:** Poor time management causes employees to feel overwhelmed, whereas excellent time management leads to increased efficiency, which in turn improves performance.

2. **Providing work on schedule:** This is the most visible advantage of excellent time management, but it is also one of the most crucial. Time management enables workers to meet deadlines, which is essential for meeting client expectations.

3. **Less anxiety and stress:** When employees are stressed and anxious, not only do they miss deadlines and produce subpar work, but it also negatively affects their health. As an employer, you are responsible for ensuring that the mental health of your employees is a top priority. Stressed employees are more prone to take sick days and seek alternative jobs.

4. **Better-quality work:** With effective time management, employees have the necessary time to produce work that is not only completed on time but also of a superior quality.

5. **Boosts confidence:** When employees are on top of their responsibilities, it boosts their confidence and enables them to believe in their own talents. In turn, this reduces tension and anxiety because the body produces dopamine.

6. **Reduces procrastination and wasted time:** Knowing how to prioritise decreases procrastination and promotes a "eat the frog" mentality among staff. This saves downtime and increases productivity.

7. **Enhances the work-life balance:** An effective work-life balance When an employee is well-rested and has the opportunity to re-energize, they are in the best position possible to produce their finest work.

8. **Make better decisions:** When employees have time to concentrate and work thoroughly, they are not required to make decisions under duress. Instead, individuals can make selections based on all the necessary information to make the greatest choice.

Time Management in Assistant Scaffolding System

Time management is essential when it comes to the assistant scaffolding system. It is critical to ensure that the system is erected and dismantled efficiently and within the project timeline. Here are some tips on how to manage time effectively in the assistant scaffolding system:

1. **Planning:** Proper planning is crucial to managing time effectively in the assistant scaffolding system. A well-planned approach can help ensure that the scaffolding is erected and dismantled in the most efficient way possible. This includes determining the scope of work, the required equipment, and the number of workers needed.

2. **Time Estimation:** Accurately estimating the time required for each task can help manage time effectively. This can be done by breaking down the work into smaller tasks and estimating the time required for each task. This will help ensure that the work is completed on time and within the project timeline.

3. **Teamwork:** As mentioned earlier, teamwork is essential in scaffolding erection and dismantle. In the assistant scaffolding system, the team must work together to ensure that the work is completed efficiently and on time. This includes effective communication, task delegation, and coordination to ensure that everyone is working together to complete the job on time.

4. **Prioritization:** Prioritizing tasks is crucial to managing time effectively in the assistant scaffolding system. It is essential to prioritize tasks based on their importance and urgency. This can help ensure that the critical tasks are completed first, and the less critical tasks are completed later.

5. **Training:** Proper training can help ensure that the workers are equipped with the necessary skills to complete the work efficiently and on time. Training can help improve productivity, reduce downtime, and minimize errors, ultimately saving time.

4.1.9. Construction Reporting

Construction reporting is the preparation of official records that provide stakeholders with information on significant events, project phases, and processes. Typically, these reports are written documents containing data. They can also describe the condition of particular project components or the budget. Construction reports should be short and written in straightforward language. Additionally, they should be simple to navigate and contain only the essential information. Additionally, they should not be replicated in other reports. Reporting on construction gives the project team excellent visibility and comprehension of what should be done. Inaccurate reporting can have significant effects on project costs and deadlines.

Objective of Construction Reporting

Construction reports are a way to comprehend the activities occurring on construction sites. In order to provide an accurate depiction of the project's state, construction reporting utilises a number of methods to collect and combine project data.

Creating reports improves comprehension of current activities and minimises the likelihood of project delays and cost overruns. The information flow from construction reporting keeps stakeholders informed and provides psychological comfort as they enjoy a project's efficient operation. Construction reports can reduce safety concerns because problems are identified and documented before they escalate.

Types of Construction Reports

There are numerous types of construction reports that detail various project operations. The majority of construction reports fall under many categories, as illustrated below.

1. Materials Report

Technological advancements have produced new construction technologies that contractors can utilise. Consequently, material reports provide construction organisations with information regarding materials that offer greater cost savings and a longer lifespan. These construction material reports are provided by a variety of organisations, and construction enterprises must enlist in order to receive their services.

2. Trend Report

Standard in the building business, trend reports provide information on various construction styles and whether their market usage is expanding or diminishing. To have access to such information, contractors must subscribe to the websites that publish studies on building industry trends. The majority of these papers are published annually and provide excellent overviews of the most recent trends and industry dynamics.

3. Cost Report

These are construction reports that tell the client and other interested parties on the expected and actual expenditures of a project. Typically, cost consultants such as quantity surveyors or contractors produce cost reports. The project is then constructed in accordance with the client-presented cost estimate. These reports are periodically updated to monitor the project's expenses. Throughout the lifecycle of a project, cost reports are in a state of ongoing evolution. Consequently, the amount of detail and precision improves as the project progresses and more information becomes available.

4. Progress Report or Daily Report

Daily reports are an integral component of project management. A daily report describes the actions of a project on a daily basis. Daily reports augment a contract by recording and confirming project progress.

These reports describe the site's specifics and keep stakeholders updated. In the event of any delays, daily reports clarify the underlying causes, thereby eliminating the time wasted disputing over the surrounding minutiae. The daily report is typically prepared by the construction manager or foreman.

Exercise

1. What are the 7 Cs of effective communication?
2. State some Adverse Effects of Poor Communication.
3. What do you understand by Workplace Communication?
4. How to enhance teamwork in the workplace?
5. Explain the importance of time management.

Notes

5. Work According to Personal Health, Safety and Environment Protocol

Unit 5.1- Workplace Hazards

Unit 5.2- Fire Safety

Unit 5.3- Safety Measures at Workplace

(CON/N9001)

Key Learning Outcomes

By the end of this module, participants will be able to:

- Explain the types of hazards at the construction sites and identify the hazards specific to the system scaffolding work
- Recall the safety control measures and actions to be taken under emergency situation
- Explain the classes of fire and types of fire extinguishers
- Demonstrate the operation of fire extinguisher.
- Demonstrate different methods involved in providing First aid to the affected person.
- Explain the importance of participation of workers in safety drills
- Demonstrate the use of all Personal Protective Equipment (PPE) like helmet, safety shoe, safety belt, safe jackets and other safety equipment relevant to scaffolding job
- Explain the reporting procedure to the concerned authority in case of emergency situations
- Describe the standard procedure for handling, storing and stacking of material, tools, equipment and accessories
- Explain different types of waste and their disposal method, which are general to the construction sites
- Explain the purpose and importance of vertigo test at construction site
- Demonstrate vertigo test
- List out basic medical tests required for working at construction Site.
- Explain the types and benefits of basic ergonomic principles, which should be adopted while carrying out specific task at the construction sites.
- Explain the importance of housekeeping
- Demonstrate housekeeping practice followed after system scaffold works

Unit 5.1 Workplace Hazards

Unit Objectives

By the end of this unit, participants will be able to:

- Explain the types of hazards at the construction sites and identify the hazards specific to the system scaffolding work.
- Recall the safety control measures and actions to be taken under emergency situation.
- Explain the reporting procedures adopted during emergency situations.
- Describe the standard procedure for handling, storing and stacking of material, tools, equipment and accessories.
- Explain the types and benefits of basic ergonomic principles, which should be adopted while carrying out specific task at the construction sites.
- Demonstrate the use of all Personal Protective Equipment (PPE) like helmet, safety shoe, safety belt, safe jackets and other safety equipment relevant to scaffolding job

5.1.1. Workplace Safety

Workplace safety is important to be established for creating a safe and secure working for the workers. The workplace has to be administered as per the rules of the Occupational Safety and Health Administration (OSHA). It refers to monitoring the working environment and all hazardous factors that impact employees' safety, health, and well-being. It is important to provide a safe working environment to the employees to increase their productivity, wellness, skills, etc.

The benefits of workplace safety are:

- Employee retention increases if they are provided with a safe working environment.
- Failure to follow OSHA's laws and guidelines can result in significant legal and financial consequences.
- A safe environment enables employees to stay invested in their work and increases productivity.
- Employer branding and company reputation can both benefit from a safe working environment.

Workplace Safety at Construction Site

To avoid injuries, accidents, and other health issues on a building site, the following safety guidelines must be followed:

1. Always wear PPE

All personnel and visitors on the construction site must wear the required PPE to reduce their exposure to potential hazards. Goggles, helmets, gloves, ear muffs or plugs, boots, and high visibility vests and suits are typical PPEs.

2. Pay attention and obey signs

Employees and visitors can be warned and made more aware of health and safety hazards through the use of safety signs. When necessary, strategically position them throughout the facility. Workers should be aware with construction site safety advice and various signs, including prohibition signs, required signs, warning signs, safe condition signs, and fire fighting equipment signs.

3. Provide precise directions

There should be a site induction or contractor induction on the job site. This will familiarise new employees with site operations. Additionally, toolbox presentations are an effective means of communicating health and safety instructions to the employees. On a daily or more frequent basis, a pre-work inspection is performed.

4. Keep site tidy

Ensure that excavation debris, dust, loose nails, and stagnant water are not lying about the site. For the prevention of slips and trips, the building site must be cleaned everyday and kept decluttered.

5. Organize and store equipment

Ensure that there are no tools laying around, and unplug all lights and power tools. The observance of building site regulations will prevent tools from becoming damaged or perhaps causing worker injury. Putting them in their proper location will help facilitate navigation.

6. Use the proper tools for the correct job

Frequently, accidents occur due to improper usage of a tool or piece of equipment. Avoid using homemade tools. Use the proper tool to complete the task more quickly and safely.

7. Have an emergency response plan

An emergency response plan instructs employees on what to do in the event of emergencies such as natural disasters, fire, hazardous material spills, and other catastrophes. Have a team committed to addressing emergency situations, answering queries, and reporting potential risks, quality issues, and near misses.

8. Set up protections

Installation of engineering controls, such as barriers, fences, and safeguards, is one method for ensuring site safety. These will aid in isolating individuals from hazardous places like high-voltage electricity or harmful chemicals.

9. Perform pre-inspection of tools and equipment.

Ensure that the tools and equipment to be utilised are free of defects or damage before beginning work.

10. Report problems immediately

Train employees to immediately report flaws and near-misses on the job site. Problems can only be resolved when management is made aware of them. The sooner problems are identified, the less likely they are to worsen and cause accidents or additional damage.

5.1.2. Workplace Hazards

A workplace is a situation that has the potential to cause harm or injury to the workers and damage the tools or property of the workplace. Hazards exist in every workplace and can come from a variety of sources. Finding and removing them is an important component of making a safe workplace.

Common Workplace Hazards

The common workplace hazards are:

- **Biological:** The threats caused by biological agents like viruses, bacteria, animals, plants, insects and also humans, are known as biological hazards.
- **Chemical:** Chemical hazard is the hazard of inhaling various chemicals, liquids and solvents. Skin irritation, respiratory system irritation, blindness, corrosion, and explosions are all possible health and physical consequences of these dangers.
- **Mechanical:** Mechanical Hazards comprise the injuries that can be caused by the moving parts of machinery, plant or equipment.
- **Psychological:** Psychological hazards are occupational hazards caused by stress, harassment, and violence.
- **Physical:** The threats that can cause physical damage to people is called physical hazard. These include unsafe conditions that can cause injury, illness and death.
- **Ergonomic:** Ergonomic Hazards are the hazards of the workplace caused due to awkward posture, forceful motion, stationary position, direct pressure, vibration, extreme temperature, noise, work stress, etc.

Workplace Hazard at Construction Site

Working on a construction site entails working with or alongside massive, functioning plant machinery and tools and working at heights and in potentially hazardous settings.
The following are a few hazards of a construction site:

- **Working at Heights:** Working at heights is the leading cause of fatal workplace injuries. All personnel working at height must receive adequate training in operating on various equipment, and such work must be carefully organised.
- **Moving Objects:** A building site is a constantly-evolving environment with numerous objects in constant motion, frequently on uneven ground. Delivery vehicles, large plant gear, and overhead lifting equipment pose a threat to workers and operators on the job site. Sites should always be designed to manage plant-to-pedestrian contact when physical barriers and enough segregation are present.

- **Slips, Trips, and Falls:** Slips, trips, and falls can occur in practically any environment, but they occur less frequently in the construction industry than in other sectors. Unsurprisingly, slips, trips, and falls are major hazards on construction sites due to the often uneven ground and ever-changing typography.

- **Noise:** Exposure to loud, excessive, and repetitive noise can result in long-term hearing issues, including deafness. Noise can also be a risky distraction, diverting a worker's attention from the task at hand, which can lead to mishaps. A full noise risk assessment should be conducted if the risk assessment identifies a noise hazard associated with the proposed work.

- **Hand Arm Vibration Syndrome:** HAVS is a painful and debilitating condition affecting the blood vessels, nerves, and joints. It is often brought on by the repeated use of hand-held power tools, such as vibrating power tools and ground-working equipment. HAVS is avoided if construction projects are structured to minimise exposure to vibration during work and if personnel utilising vibrating tools and equipment are monitored and properly protected.

- **Material Handling - Manual and with Equipment:** On construction sites, materials and equipment are continuously lifted and transported, either manually or with equipment. Handling always carries a degree of danger.

- **Excavations:** On construction sites, incidents frequently occur within excavations, such as an unsupported excavation collapse with employees inside.

- **Electricity:** Contact with overhead or subsurface power cables and electrical equipment/ machinery accounts for most of these mishaps. The standard in the construction industry is service strikes. The strikes occur when excavation is performed without a sufficient search for existing utilities. Consequently, problems can be readily averted by employing technologies such as CAT and Genny scanning equipment to scan an area, anticipate prospective services, and prevent service interruptions.

Hazards Specific to System Scaffolding Work

System scaffolding is a type of scaffolding that is assembled from prefabricated components or parts. It is commonly used in construction, maintenance, and repair work. While system scaffolding is a safe and efficient solution for working at heights, there are specific hazards that workers need to be aware of. Here are some of the hazards specific to system scaffolding work:

1. **Falls:** Falls from height are a significant hazard in system scaffolding work. Workers must be provided with appropriate fall protection, such as guardrails, personal fall arrest systems, or safety nets. The scaffolding must also be designed and erected to prevent falls.

2. **Collapse:** System scaffolding must be erected and dismantled correctly to prevent collapse. Incorrect assembly, overloading, or incorrect use of the scaffolding can cause it to collapse, leading to serious injuries or even death.
3. **Falling objects:** Objects can fall from the scaffolding, endangering workers and bystanders below. Proper precautions must be taken to prevent objects from falling, such as using toe boards, debris nets, or scaffolding barriers.
4. **Electrocution:** System scaffolding work can be hazardous if it is near power lines or electrical sources. Workers must be trained to recognize and avoid electrical hazards and to use appropriate protective equipment.
5. **Chemical exposure:** Some system scaffolding work may involve exposure to hazardous chemicals, such as lead, asbestos, or toxic substances. Workers must be trained to recognize and avoid chemical hazards and to use appropriate protective equipment.
6. **Poor visibility:** Poor visibility can increase the risk of accidents in system scaffolding work. Workers must be provided with adequate lighting and visibility to ensure they can see what they are doing and avoid hazards.

Workplace Hazards Analysis

A workplace hazard analysis is a method of identifying risks before they occur by focusing on occupational tasks. It focuses on the worker's relationship with the task, the tools, and the work environment. After identifying the hazards of the workplace, organisations shall try to eliminate or minimize them to an acceptable level of risk.

Control Measures of Workplace Hazards

Control measures are actions that can be taken to reduce the risk of being exposed to the hazard. Elimination, Substitution, Engineering Controls, Administrative Controls, and Personal Protective Equipment are the five general categories of control measures.

- **Elimination:** The most successful control technique is to eliminate a specific hazard or hazardous work procedure or prevent it from entering the workplace.
- **Substitution:** Substitution is the process of replacing something harmful with something less hazardous. While substituting the hazard may not eliminate all of the risks associated with the process or activity, it will reduce the overall harm or health impacts.
- **Engineering Controls:** Engineered controls protect workers by eliminating hazardous situations or creating a barrier between the worker and the hazard, or removing the hazard from the person.

- **Administrative Controls:** To reduce exposure to hazards, administrative controls limit the length of time spent working on a hazardous task that might be used in combination with other measures of control.

- **Personal Protective Equipment:** Personal protective equipment protects users from health and safety hazards at work. It includes items like safety helmets, gloves, eye protection, etc.

5.1.3. Hazard Identification and Risk Assessment (HIRA)

Hazard Identification and Risk Assessment (HIRA) is conducted to identify undesired events that can lead to a hazard, analyse the hazard of this undesirable event, and estimate its scope, magnitude, and possibility of detrimental effects. Within the industry, it is commonly acknowledged that the various risk assessment approaches contribute significantly to improving the safety of complex processes and equipment.

This analysis of hazards and risks aims to identify and assess hazards, the event sequences that lead to hazards, and the risk associated with hazardous occurrences. There are numerous strategies for identifying and analysing dangers, ranging from simple qualitative procedures to advanced quantitative methods. Multiple methodologies for hazard analysis are advised because each has its objective, strengths, and weaknesses.

To manage risk, risks must first be identified, and then the risk must be assessed and its acceptability established.

The earlier an effective risk analysis is conducted in the life cycle, the more cost-effective the future safe operation of the process or activity is expected to be. Most of the facility's other process safety management tasks are based on understanding the risk obtained via these studies. An inaccurate perception of risk at any time could result in inefficient use of scarce resources or the unwitting acceptance of hazards that exceed the genuine tolerance of the organisation or community.

Procedure for HIRA:

At each stage of the work life cycle, a review team questions process specialists about potential hazards and evaluates the risk of any detected hazards. There are numerous typical ways to evaluate a design, ranging from straightforward qualitative checklists to extensive quantitative fault tree analysis. Typically, the results of the review process are recorded on a worksheet whose level of information varies according to the stage of the job and the evaluation method employed. Typically, risk evaluations on operational processes are regularly updated or revalidated.

This work's objective is to detect hazards and risks by assessing each step involved in various building activities and to provide recommendations to remove or reduce the risk assessment (HIRA). The

industry achieves success by satisfying production objectives and ensuring high employee satisfaction by meeting workplace safety criteria. Regularly, hazards and risk assessments should be performed, and steps should be taken to reduce the risk to an acceptable level.

HIRA Process it consist of four steps as follows:

i. Hazard identification
ii. Risk assessment
iii. Risk analysis
iv. Monitor and review

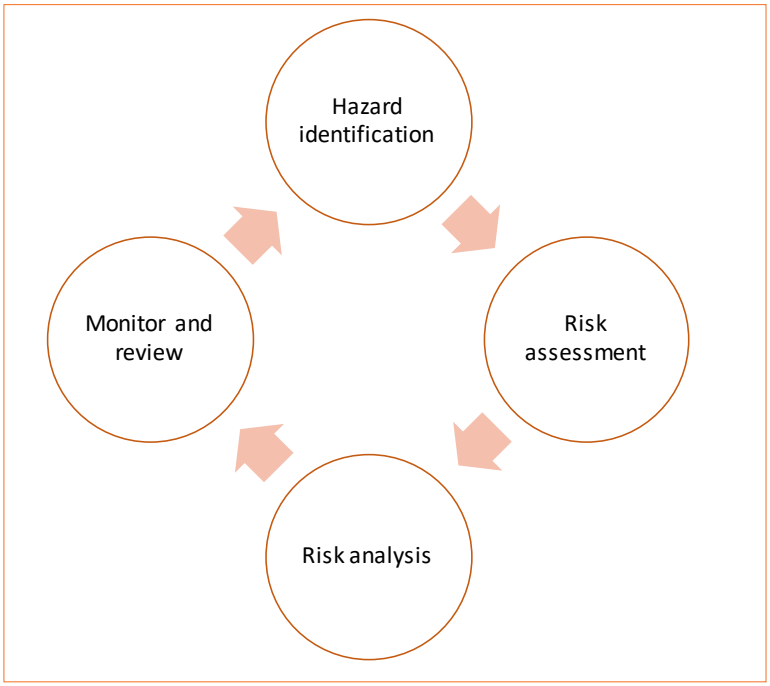

Fig. 5.1.1 HIRA Process

6.1.4. Workplace Warning Signs

A Hazard sign is defined as 'information or instruction about health and safety at work on a signboard, an illuminated sign or sound signal, a verbal communication or hand signal.'

There are four different types of safety signs:

- Prohibition / Danger Alarm Signs
- Mandatory Signs
- Warning Signs
- And Emergency

1. **Prohibition Signs:** A "prohibition sign" is a safety sign that prohibits behaviour that is likely to endanger one's health or safety. The colour red is necessary for these health and safety signs. Only what or who is forbidden should be displayed on a restriction sign.

Fig. 5.1.2 Prohibition Warning Signs

2. **Mandatory Signs:** Mandatory signs give clear directions that must be followed. The icons are white circles that have been reversed out of a blue circle. On a white background, the text is black.

Fig. 5.1.3 Mandatory Signs

3. **Warning Signs:** Warning signs are the safety information communication signs. They are shown as a 'yellow colour triangle'.

Fig. 5.1.4 Warning Signs

4. **Emergency Signs:** The location or routes to emergency facilities are indicated by emergency signs. These signs have a green backdrop with a white emblem or writing. These signs convey basic information and frequently refer to housekeeping, company procedures, or logistics.

Fig. 5.1.5 Emergency Signs

5.1.5. Personal Protective Equipment

Personal protective equipment, or "PPE," is equipment worn to reduce exposure to risks that might result in significant occupational injuries or illnesses. Chemical, radiological, physical, electrical, mechanical, and other job dangers may cause these injuries and diseases.

The right PPE is essential in scaffolding work to ensure the safety of workers. Employers should ensure that all workers are trained on how to properly use and maintain their PPE.

Here are the different types of PPE that are commonly used in scaffolding:

Injury Protection	Protection	PPE
Helmet	This protects the worker's head from falling objects or bumps. It should fit snugly and be adjusted properly.	
Safety Shoes	This protects the worker's feet from falling objects, sharp objects, and slips. It should have a non-slip sole and be made of sturdy material.	
Safety Belt	This protects the worker from falls. It should be properly anchored and adjusted to fit snugly.	
Safe Jackets	This provides visibility and protection from the weather. It should be made of reflective material and be adjustable to fit properly.	
Safety Glasses	This protects the worker's eyes from dust, debris, and other hazardous materials. It should be made of shatterproof material and fit snugly.	
Gloves	This protects the worker's hands from cuts, abrasions, and other injuries. It should be made of durable material and fit snugly.	

Table 5.1.1 Commonly Used PPE in scaffolding

5.1.6. Basic Ergonomic Principles

The basic ergonomic principles for construction are:

1. Work in neutral space.

Whether working seated or standing and moving throughout the day, it is essential to maintain a neutral posture. Several parts of the body are typically affected by this principle. The foremost is the rear. A healthy spine has an S-curve, and it is essential to maintain this curve when working to prevent back pain. When working in a seated position, lumbar support is essential. When standing stationary, it can be advantageous for those who stand or move around a facility to rest one foot on a footrest, and when lifting, it is important to lift using your legs rather than your back.

Neck, elbows, and wrists are additional parts of the body that may be misaligned. To lessen tension on these areas and maintain their alignment, try modifying your equipment or work position so that your muscles remain in a relaxed state.

2. Reduce the necessity for excessive force.

Imagine a time when you had to move an object using your entire body weight. This is what the principle refers to. Heavy pushing, pulling, and lifting can strain your joints, potentially leading to weariness or injury. Instead of employing unnecessary force, look for equipment or methods that can lighten the load you must move. It may be as easy as using a cart or hoist to transport heavy objects, or you may need to modify your workflow to reduce the distance you must go or the number of objects you must transport.

3. Keep materials easily accessible.

Try extending your arms in front of you and drawing a half-circle with them. This is your reach envelope, and you should keep goods you use regularly within this semicircle at your desk. To accommodate your reach envelope, you may need to rearrange your space so that you no longer have to reach for often used goods. Adjusting your seat and armrests can help alleviate fatigue by bringing machine controls within reach.
Also applies while reaching into boxes or containers. Before reaching into a box, tilt it or lay it on a lower surface instead than straining your shoulders to reach higher.

4. Work at the appropriate height.

A work surface that is either too high or too low might cause back, neck, and shoulder strain. Standing or sitting, the majority of normal tasks should be performed at elbow height. Nonetheless, if you work with heavy instruments, you may need to change your position to work below elbow height. On the other hand, precision work may necessitate working at heights above the elbow.

5. Reduce needless movements.

Manual repetition can result in overuse injuries, thus it is essential to consider the motions you repeat throughout the day and identify solutions to prevent excessive motion. Is it conceivable, for instance, to replace a screwdriver with a drill, so eliminating the need for manual motion? Additionally, you might seek for possibilities to alter your position or the arrangement of your workspace in order to operate in a more ergonomic manner.

6. Reduce fatigue resulting from static stress.

There may be tasks at work that need you to maintain the same position for a lengthy period of time. This is known as static load. Static load can impact various regions of the body, including the legs while standing for an extended period of time and the shoulders when holding the arms overhead for more than a few seconds. These types of tasks might create muscle fatigue and discomfort that persists long after the work is completed. You may be able to prevent the weariness generated by static load by altering the orientation of your work area, repositioning your body, or using tool extenders.

7. Minimize contact stress.

When a tool or surface repeatedly comes into contact with the same part of your body, contact stress occurs. Sometimes referred to as pressure points, these places of contact can be painful. When you habitually squeeze a tool, such as pliers, or hold a heavy object, such as a nail gun, that exerts pressure on a portion of your hand, this is an example of contact stress. Adding padding, wearing gloves, or selecting equipment with a padded grip can be beneficial. Consider adding anti-fatigue mats to standing surfaces to reduce heel contact stress.

8. Leave adequate clearance.

This idea is straightforward: you must have adequate space for your head, knees, and feet. Adjust your seat to allow sufficient legroom if you perform your duties while seated. Remove above obstacles to avoid head injuries. Visibility also plays a role in this scenario. It is essential to have a clear perspective of your surroundings regardless of where you are working or what equipment you are employing.

9. Stay active and flexible throughout the day.

Sitting or standing in one posture for too long is unhealthy for the human body. Take time to stretch and exercise your muscles. If you are sedentary for an extended amount of time, take frequent breaks to walk around. If you are on your feet all day, wear supportive shoes and rest during your breaks. And if your profession is physically demanding on specific sections of your body, it may be beneficial to stretch before to undertaking tough duties.

10. Keep your atmosphere comfortable.

Depending on your sector and position, work conditions vary widely, but lighting, temperature, vibration, and noise are a few common factors you may want to consider. Consider strategies to reduce glare or improve lighting in dimly lit places. Whenever feasible, maintain a pleasant temperature in the workplace, and when working outside, dress appropriately for the weather. And if the tools produce excessive noise or vibration, give hearing protection and seek methods to attenuate the vibrations.

5.1.7. Emergency Response Plan for Construction Site

Construction projects are commonly recognised as one of the most accident-prone activities. It must be realised that the size and complexity of a project determines the associated dangers and risks. In the majority of cases, poor response, a lack of resources, or the absence of trained staff on a building site will result in chaos. In order to reduce human suffering and financial losses, it is strongly suggested that the emergency response plan be developed prior to project launch.

The Emergency Response Plan must address the following factors:

1. Statutory Obligations

The entity must comply with all applicable Central and State Rules and Regulations, such as The Building and Other Construction Workers' Act of 1996, the Environment (Protection) Act of 1986, the Factories Act of 1948, the Inflammable Substances Act of 1952, the Motor Vehicles Act of 1988, the Public Liability Insurance Act of 1991, the Petroleum Act of 1934, the National Environment Tribunal Act of 1995, and the Explosives Act of 1874, etc.

Incorporate applicability and compliance status into the Emergency Response Plan.

2. Emergency Preparedness

a. The process of hazard identification and risk assessment entails a thorough review of construction activities such as Excavation, Scaffolding, Platforms & Ladders, Structural Work, Laying of Reinforcement & Concreting, Road Work, Cutting /Welding, Working in Confined Space, Proof/Pressure Testing, Working at Heights, Handling & Lifting Equipment, Vehicle Movement, Electrical, Demolition, Radiography, Shot blasting

b. Listing On-Site (Level I & II) and Off-Site (Level III) Emergency Scenarios in accordance with their effects and available resources.

3. Measures for Emergency Mitigation

To ensure safety during construction activities, the business must have an appropriate Health, Safety, and Environment Management System in place.

a. Health, Safety, and Environment (HSE) Policy;
b. Duties and Responsibilities of Contractor/Executing Agency;
c. Site planning and layout;
d. Deployment of Safety Officer/Supervision;
e. Safety committees with fair participation of workers;
f. Safety audits and inspections shall be conducted using prescribed checklists.
g. Work permit system h) PPE I Safety awareness and training, etc.

4. Measures for Emergency Preparedness

a. Emergency Drill and Exercise on Identified Scenarios and Evaluations b) Emergency Response Training
b. Mutual Aid

5. Disaster Recovery Procedures

The entity must develop well-planned and documented response procedures. The action plan may be documented for both On-site and Off-site disaster scenarios.

6. Organization and Responsibilities during Emergencies

The entity must create an organisation chart (emergency action flowchart) and specify the roles and duties of key individuals in order to properly handle an emergency scenario on the project site. Clause 14.0 of the PNGRB (ERDMP) Regulations may be consulted in order to establish the emergency organisation and responsibilities.

7. Resources for Emergency Management

1. The following emergency control systems and facilities must be provided on the project/ construction site: -

    a. Fire and gas detection system
    b. Fire protection and firefighting system (Active and Passive)
    c. Ambulance facility on-site; if not, on urgent call basis.
    d. Rescue facilities and personal protective equipment (PPEs)
    e. First aid stations.
    f. Medical facility on-site or affiliation with a local hospital or medical centre

g. Internal and External Communication Facilities as well as a Notification System

h. Gathering places

i. Escape route and evacuation zones

2. Internal and External Emergency contact information for police, fire, hospitals, mutual assistance industry, factory inspectors, Board, State Pollution Control Board, Petroleum and Explosive Safety Organization (PESO), etc.

3. Addresses and Telephone Directory of Technical Support Services and Professional Emergency Responders

8. Emergency Recovery Method

Following the emergency, the following tasks must be completed in detail.

a. Information to legal authorities (Refer to Clause 23.0 for Incident Reporting to PNGRB).

b. Incident examination.

c. Damage evaluation.

d. Product salvage, decontamination, clean-up, and restoration.

e. A comprehensive report shall be compiled based on the complete incident experience, including restorations, restrictions, and lessons learned.

Notes

Unit 5.2 Fire Safety

Unit Objectives

By the end of this unit, participants will be able to:

- Explain the classes of fire and types of fire extinguishers.
- Demonstrate the operating procedure of the fire extinguishers.

5.2.1. Fire and its Classes

Fires can be catastrophic. Burning, hurting, and even murdering people. causing property and equipment damage. Disrupting corporate operations. Fire may take lives and destroy businesses.

Fire prevention is the most effective technique to prevent fire from affecting you or your organisation. In addition to preventing fires from starting, you should also have a plan in place for responding to flames if they occur.

There are five distinct classes of fire:

Class A: Ordinary solid combustibles, including paper, wood, fabric, and certain polymers.

Class B: Flammable liquids such as alcohol, ether, oil, gasoline, and grease that should be smothered.

Class C: Electrical equipment, appliances, and wiring where applying a nonconductive extinguishing chemical minimise electrical shock-related injuries. Don't use water.

Class D: Certain combustible metals, including sodium and potassium. These items are not often found at the Medical Center.

Class K: Flames caused especially by cooking fat or oil.

5.2.2. Fire Safety

Fire safety is a set of actions aimed at reducing the amount of damage caused by fire. Fire safety procedures include both those that are used to prevent an uncontrolled fire from starting and those that are used to minimise the spread and impact of a fire after it has started. Developing and implementing fire safety measures in the workplace is not only mandated by law but is also essential for the protection of everyone who may be present in the building during a fire emergency.

The basic Fire Safety Responsibilities are:

- To identify risks on the premises, a fire risk assessment must be carried out.
- Ascertain that fire safety measures are properly installed.
- Prepare for unexpected events.
- Fire safety instructions and training should be provided to the employees.

Prevention of a Workplace Fire

- Workplace fire drills should be conducted regularly.
- If one has a manual alarm, one should raise it.
- Close the doors and leave the fire-stricken area as soon as possible. Ensure that the evacuation is quick and painless.
- Turn off dangerous machines, and don't stop to get personal items.
- Assemble at a central location. Ascertain that the assembly point is easily accessible to the employees.
- If one's clothing catches fire, one shouldn't rush about it. They should stop, descend on the ground, and roll to smother the flames if their clothes catch fire.

5.2.3. Fire Extinguisher

Fire extinguishers are portable devices used to put out small flames or minimise their damage until fire-fighters arrive. These are maintained on hand in locations such as fire stations, buildings, workplaces, public transit, and so on. The types and quantity of extinguishers that are legally necessary for a given region are determined by the applicable safety standards.

Types of fire extinguishers are:

There are five main types of fire extinguishers:

1. Water.
2. Powder.
3. Foam.
4. Carbon Dioxide (CO_2).
5. Wet chemical.

1. **Water:** Water fire extinguishers are one of the most common commercial and residential fire extinguishers on the market. They're meant to be used on class-A flames.

2. **Powder:** The L2 powder fire extinguisher is the most commonly recommended fire extinguisher in the Class D Specialist Powder category, and is designed to put out burning lithium metal fires.

3. **Foam:** Foam extinguishers are identified by a cream rectangle with the word "foam" printed on it. They're mostly water-based, but they also contain a foaming component that provides a quick knock-down and blanketing effect on flames. It suffocates the flames and seals the vapours, preventing re-ignition.

4. **Carbon Dioxide (CO2):** Class B and electrical fires are extinguished with carbon dioxide extinguishers, which suffocate the flames by removing oxygen from the air. They are particularly beneficial for workplaces and workshops where electrical fires may occur since, unlike conventional extinguishers, they do not leave any toxins behind and hence minimize equipment damage.

5. **Wet Chemical:** Wet chemical extinguishers are designed to put out fires that are classified as class F. They are successful because they can put out extremely high-temperature fires, such as those caused by cooking oils and fats.

Notes

Unit 5.3 Safety Measures at Workplace

Unit Objectives

By the end of this unit, participants will be able to:

- Explain the importance of housekeeping practice followed after system scaffold works.
- Demonstrate safe housekeeping practices.
- Explain the importance of participation of workers in safety drills.
- Explain the purpose and importance of vertigo test at construction site.
- List out basic medical tests required for working at construction site.
- Demonstrate vertigo test.
- Demonstrate different methods involved in providing First aid to the affected person
- Demonstrate safe waste disposal practices followed at construction site.
- Explain different types of waste at construction sites and their disposal method.

5.3.1. Safety, Health and Environment at Work Place

The Indian Constitution gives explicit standards for people's rights and the Directive Principles of State Policy, which offer a framework for the acts of the government. The government is dedicated to regulating all economic activities for the management of safety and health risks at workplaces and to implementing steps to provide safe and healthy working conditions for every man and woman in the country. This commitment is supported by both these Directive Principles and international instruments. The government recognises that worker health and safety contribute to both economic growth and worker output.

5.3.2. Good Housekeeping

Good housekeeping on construction sites refers to the practice of keeping your site clean and tidy. After all, construction work is messy, and cleaning up now will only result in more mess later.

A clean work environment reduces the likelihood of accidents and improves fire safety. There are fewer things to trip you up if there are no materials, waste, or discarded tools.

10 housekeeping rules for a clean site. Implement these, and you should see a decrease in slip and fall accidents and near misses among your employees.

1. Make a separate area for trash and waste.

Make a waste disposal area. After all, if you want your workspace to be free of waste materials, you'll need a place to store them. Depending on the amount of waste, this could be a skip or another waste disposal bin. Segregating waste types for reuse, recycling, or landfill is a best practice solution.

2. Safely stack and store materials.

Poorly stacked materials can obstruct access routes or topple over, resulting in crushing injuries or property damage. You will need materials and tools throughout your project; store them safely to avoid them becoming hazardous.

3. Maintain a safe working environment.

On a construction site, your job will almost certainly generate daily waste. Whether it's packaging, demolition, or leftovers. Check and clean up your work area regularly throughout the day. If trip hazards and clutter are beginning to accumulate, address them as soon as possible.

4. Maintain clear access routes.

A safe working environment includes access and egress. It is how you arrive at work and how you leave. Leave no materials/tools/benches in gangways/corridors where they could obstruct someone's escape or cause a trip hazard (it might be you or a colleague who needs to get out in a hurry).

5. Place tools at designated place after use.

Put away tools and equipment after you've finished using them. It's easy to leave items lying around, but if you won't need them again soon, store them. If it's not in use, it should be out of sight, or at the very least out of your way!

It is not your responsibility simply because it is not yours. If you see anything lying on the floor, stairwell, or passageway that could cause people to trip and fall, pick it up and put it somewhere safe - don't wait for someone else to move it; the next person could be the one who gets hurt.

6. If something is broken, fix it.

Fix it or get rid of it. Good housekeeping also entails keeping things in working order on-site. Damaged tools or equipment must be removed from service so that they can be repaired or replaced.

7. Avoid tripping over cables.

Equipment trailing leads and cables are common trip hazards, especially when using portable equipment. You may not have a socket nearby, but make sure the lead is routed away from walkways or access routes. Cables should be routed so that they do not present a tripping hazard to you or others.

8. Avoid fire hazards.

Make sure that waste or material storage does not accumulate in fire escapes, as you may need to use these escapes at some point. Clearing up and removing waste is also a good way to keep fires at bay on the job site. Because fire requires fuel, do not store waste materials near sources of ignition. If all garbage is collected on a regular basis and placed in a skip, the danger is contained and more easily dealt with in the event of a fire.

9. Inform others.

Everyone must work together to keep the workplace clean. Use our free good housekeeping toolbox talk to raise awareness on your site. If everyone follows the same good housekeeping routines, you will be well on your way to a clean and safe site for everyone.

5.3.3. Importance of Housekeeping Practice followed after System Scaffold Works

Proper housekeeping practices after system scaffold works are essential for the safety, compliance, efficiency, equipment maintenance, and professionalism of the worksite.

Housekeeping practice after system scaffold works is essential for several reasons:

1. **Safety:** When a scaffold is erected, it can create a lot of debris and waste materials, which can pose a safety hazard to workers and others in the area. Removing this waste and debris is crucial to maintain a safe working environment.

2. **Compliance:** Housekeeping is an essential aspect of workplace safety and is often required by regulations and industry standards. Failure to follow proper housekeeping procedures can result in fines and legal liabilities.

3. **Efficiency:** Keeping the worksite clean and organized can help workers operate more efficiently. With a tidy workplace, workers can access the tools and equipment they need more quickly, reducing downtime and increasing productivity.

4. **Equipment maintenance:** During scaffold works, various equipment such as scaffolding components, power tools, and other machinery are used. Proper housekeeping practices ensure that this equipment is adequately maintained and stored after use, extending its lifespan and reducing replacement costs.

5. **Professionalism:** A clean and organized worksite reflects positively on the reputation of the company and demonstrates a commitment to safety and professionalism.

5.3.4. Safety Drills at Construction Site

Construction is a hazardous field in which employees must become proficient. Fortunately, safety training can reduce workplace injuries while informing employees of necessary precautions to take.

Here are five types of construction industry safety training one should be aware of.

Safety in Excavation and Trenching

Training on excavation and trenching safety emphasises the dangers associated with working in excavation sites and confined spaces. The training enables workers to navigate these areas safely in order to prevent falls and fatalities. In addition, the programme emphasises preplanning and protective systems (which fall under OSHA-compliant safety material). Workers will be educated on the various excavation methods and techniques in order to perform their duties safely.

Fall Prevention and Safety Measures

Fall prevention and protection training is another type of safety training that all construction workers must receive. Falls are one of the leading causes of death in the industry; therefore, it is essential that workers protect themselves. Fall prevention programmes illustrate fall protection principles, fall arrest system components, and fall hazard recognition. Moreover, demonstrations familiarise workers with fall protection equipment.

Hazard Communication

On a daily basis, construction workers are exposed to hazardous materials and chemicals at their work sites. A worker's health and safety may be compromised by repeated exposure to such substances. Training on hazard communication includes the numerous types of chemicals used in the workplace as well as methods for minimising worker exposure. In addition, employees are taught how to read material safety data sheets and identify product labels.

Crane Hazards Management

Cranes pose a distinct hazard in the construction industry because of the diverse causes of these injuries. For instance, improper placement of loads, contact with overhead electricity lines, and structural failures can result in injuries and fatalities. Nevertheless, crane hazard management develops a grasp of OSHA compliance rules, which enhances job site safety and decreases the likelihood of employee accident.

Construction Industry OSHA Course

OSHA courses for the construction sector equip novice and seasoned workers with a general understanding of diverse construction sites. In addition to an introduction to OSHA, employees will receive training on issues including material handling, ergonomics, access into restricted spaces, and site-specific policies. This course is designed to cover industry-wide themes and handle safety issues.

5.3.5 Medical Examination for Construction Workers

The government has mandated that industrial enterprises undertake annual health checkups on their employees. In accordance with the Factories Act of India from 1948, both contractual and permanent employees in manufacturing businesses are required to undergo periodic health examinations. These examinations aim to protect the health and safety of factory workers.

The type of medical examination varies according to an employee's job description or the nature of the industrial process in which he is involved. For instance, if an employee works in the food business, their hands are routinely inspected for skin disorders. If someone is involved in a hazardous manufacturing process, chest X-rays may be part of the medical checkup.

Consequently, depending on the nature of the production process and the job profile, an employee may be subjected to all standard and specific tests.

In addition, the frequency of medical examinations varies. According to the Maharashtra Plant Rules, for instance, if the factory is involved in the production of lead, workers are inspected once every month.

Medical Check-up Prior to Employment: A young person must have a pre-employment medical examination by a Certifying Surgeon to determine and confirm his fitness to work in a factory, according the Factories Act of 1948. The certificate of fitness is only valid for one year from the date it was issued.

Medical Examinations for Workers in Hazardous Occupations: According to the Factories Act, a plant that engages in hazardous procedures is required to have its employees examined by a competent medical professional prior to employment and on a recurrent basis thereafter. Workers employed in a "hazardous process" are medically tested once before to employment by a Factory Medical Officer to determine their physical fitness and appropriateness for employment in a hazardous process.
Once every six months, the health status of all workers exposed to occupational health hazards must be determined.

Form 7 is completed, and if the medical findings reveal any abnormality or unsuitability of a person employed in the hazardous process, or if the worker or employee has manifested signs and symptoms of a notifiable disease (as specified in the Third Schedule of the Factories Act), the worker must be removed from the process for health protection and cannot be employed in the same process. Alternatively, if the worker is totally handicapped, he or she will receive appropriate rehabilitation. Only after obtaining a Fitness Certificate from the Certifying Surgeon and Form 7 in accordance with the Factories Act may a withdrawn employee be rehired for the same process.

List of Recommended Medical Tests under the Factories Act:

1. Complete Physical Examination
2. Blood Group, Rh factor
3. Blood CBC, ESR, RBS
4. Urine Test (Routine & Microscopic)
5. Creatinine
6. Electrocardiogram (Computerised ECG)
7. Chest X-Ray (Standard Size)
8. Lung Function Test
9. Vision Test (Screening)
10. Audiometric Test
11. HIV & HBS Tests

5.3.6. Vertigo Test

Vertigo is a symptom, not a condition in and of itself. Vertigo is a sort of dizziness that is frequently described as the sensation that one is spinning or that the world is spinning around them, especially when they alter their position. Vertigo affects people of all ages. Middle ear pathology is typically the culprit in younger patients. The danger of falls and associated sequelae necessitates a specialised assessment of the elderly. The key to arriving at a diagnosis is distinguishing vertigo from other causes of dizziness or imbalance, as well as distinguishing central causes of vertigo from peripheral causes.

Vertigo is a symptom that is associated with numerous medical disorders. Your doctor may require one or more tests or procedures to better understand your underlying issue. Numerous of these tests require specialised equipment and experienced personnel.

Some exams are brief and painless, while others are lengthy and unpleasant. Your doctor can recommend the relevant tests for your condition.

Diagnostic Procedures Typically Employed for Vertigo

Following a discussion of your symptoms, a review of your medical history, and a general physical examination, your physician may recommend one or more of the following tests:

Dix-Hallpike Maneuver

If your doctor suspects you have benign paroxysmal positional vertigo (BPPV), the most frequent type of vertigo, he or she may employ the Dix-Hallpike manoeuvre. This procedure can also assist your doctor in determining if your vertigo is caused by an inner ear disorder or something in your head.

The physician will rotate your head 45 degrees to one side. Then, you will immediately lie on your back with your head off the edge of the table for at least 30 seconds. Your physician will examine your eyes and inquire whether you feel dizzy. The process is repeated on the opposite side.

You should be aware that this examination could induce vertigo. If you experience symptoms during this examination, your physician will conclude that you have vertigo.

Head Impulse Test

The head impulse test examines the coordination between your eyes and inner ears. It is frequently utilised when vestibular neuritis is suspected. Your doctor will quickly twist your head to search for rapid eye movements and reflexes that may indicate a problem with the semicircular canals of the inner ear.

Romberg Test

The Romberg test requires that you stand with your feet together. You will then close your eyes. Your doctor will evaluate the degree to which you wobble or fall to establish the cause of your vertigo.

Fukuda-Unterberger Test

The Fukuda-Unterberger test consists of a blindfolded march. To determine which side of your body is afflicted by vertigo, your doctor will evaluate how your body deviates from the midline.

Electronystagmography (ENG) or Videonystagmography (VNG) Electronystagmography (ENG) and Videonystagmography (VNG) are used to identify aberrant eye movements and assess if vertigo symptoms are caused by an inner ear condition.

ENG employs electrodes and VNG uses small cameras to monitor eye movements while the head is put in various postures or while the subject is requested to track specific visual targets. Air or water may also be utilised to regulate the temperature of the ear canal. Typically administered in a dark setting, these examinations may induce jerking eye movements.

Rotation Test

To determine how well the eyes and inner ear work together, rotation tests are administered. Eye movements are analysed while the head is slowly moved from side to side. Different types of rotation tests exist. You may be required to sit in a chair that swivels or to look at a stationary target while moving your head back and forth or up and down.

5.3.7. First Aid

First aid is the treatment or care given to someone who has sustained an injury or disease until more advanced care can be obtained or the person recovers.

The aim of first aid is to:

- Preserve life
- Prevent the worsening of a sickness or injury
- If at all possible, relieve pain
- Encourage recovery
- Keep the unconscious safe.

First aid can help to lessen the severity of an injury or disease, and in some situations, it can even save a person's life.

Need for First Aid at the Workplace

In the workplace, first aid refers to providing immediate care and life support to persons who have been injured or become unwell at work.

Many times, first aid can help to lessen the severity of an accident or disease.

It can also help an injured or sick person relax. In life-or-death situations, prompt and appropriate first aid can make all the difference.

Treating Minor Cuts and Scrapes

Steps to keep cuts clean and prevent infections and scars:

- **Wash Hands:** Wash hands first with soap and water to avoid introducing bacteria into the cut and causing an infection. One should use the hand sanitiser if one is on the go.

- **Stop the bleeding:** Using a gauze pad or a clean towel, apply pressure to the wound. For a few minutes, keep the pressure on.

- **Clean Wounds:** Once the bleeding has stopped, clean the wound by rinsing it under cool running water or using a saline wound wash. Use soap and a moist washcloth to clean the area around the wound. Soap should not be used on the cut since it may irritate the skin. Also, avoid using hydrogen peroxide or iodine, as these may aggravate the wound.

- **Remove Dirt:** Remove any dirt or debris from the area. Pick out any dirt, gravel, glass, or other material in the cut with a pair of tweezers cleaned with alcohol.

5.3.8. Waste Management

The disorderly nature of construction sites can make it difficult for workers to remain productive. By applying waste management methods from the outset of the project, one will aid in maintaining order and keeping everyone focused on their jobs.

- **Avoid Accidents:** To prevent accidents, the workers must ensure that waste and debris are properly disposed of. Ensure that they are aware of which objects are hazardous in the event of a fire or an object being thrown into machinery.

- **Reduce Cost:** Managing garbage on-site can assist decrease costs by minimising the cost of removal, in addition to improving safety.

- **Maintain a wholesome working atmosphere:** To maintain a healthy building site, workers will need a variety of equipment and supplies, such as wheelbarrows for transporting dirt and pallets for storing bricks and other heavy items. Ensure that there are always sufficient rubbish bins available so that the workers may dispose of the trash without difficulty.

- **Keeping Material Records:** All building materials must be accounted for at all times to prevent their accidental disposal. This contributes to cost control and time management. If using Reo mesh for wall stability, one would not want to waste such a valuable resource. This occurs frequently on construction sites and may be controlled with simple procedures. This can be as easy as choosing various colours for waste piles or maintaining a log. Materials that are no longer required should never be discarded until they have reached the end of their functional life on the site; in other words, until nothing can be salvaged from them.

- **Environmentally Responsible:** Waste management is also essential since it ensures the environmental friendliness of a project. If garbage is not disposed of in an environmentally responsible manner, it can negatively impact the local ecology and nearby places by contaminating streams and contributing to air pollution.

Waste and Debris Management on the Construction Site

On the construction site, one must be mindful of how they handle waste and garbage. Having a plan for managing these goods is necessary to protect the safety of both workers and the general public. Here are some waste management strategies:

- Before disposing of them in the dumpster, place any hand tools in containers with lids.
- Place empty paint cans in the trash instead than spilling them down drains or onto pavements.
- Rinse disposable cups and other food containers before placing them in a recycling bin. This will help prevent litter from being blown onto the property during windy or rainy weather.
- Recycle equipment and other metal objects by utilising a magnet or air compressor to remove all non-metal components, such as nails, screws, nuts, bolts, electrical wiring, etc. These are then segregated by category prior to proper recycling.

- Insulation should be disposed of in the garbage as opposed to being poured down drains or onto pavements, as it can clog sewer systems.
- Use a tarp to pile dirt, rocks, bricks, and other heavy things into the bed of a truck before hauling them away when the work is complete. This will make future clean-up easier.
- Instead of discarding excess lumber, wrap it in plastic to prevent it from becoming wet and infected with termites.
- Use a leak-proof container or urn to transfer hazardous liquids away for proper disposal; this will keep the workers and others on-site dry and healthy.
- Regularly cleaning up will reduce the amount of debris.
- Using trash cans with lids to prevent rubbish from falling to the ground.
- On your site, provide workers with safety vests for simple identification and protection from concealed threats such as electrical cables and sharp instruments.
- Ensure that there is a designated space for recyclable materials such as glass, plastic, cardboard, and metal containers so that they may be sorted later.

It is essential to have a plan for waste management on construction sites, which are typically untidy places.

Exercise

1. Name the types of fire extinguishers.
2. Explain PPE in brief.
3. Explain the importance of workplace safety at construction site.
4. What do you understand by good housekeeping?
5. Why are safety drills at construction site important?

Notes

6.Employability Skills (30 Hours)

It is recommended that all trainings include the appropriate Employability skills Module. Content for the same can be accessed https://www.skillindiadigital.gov.in/content/list

Scan the QR code below to access the eBook

DGT/VSQ/N0101

Employability skills can be defined as those soft skills which employers look for in a potential employee. These skills equip the employees to carry out their role to the best of their ability and client satisfaction. For example, the ability to explain what you mean in a clear and concise way through written and spoken means, helps to build a better relationship with the client or the customer. Similarly, handling stress that comes with deadlines for finishing work and ensuring that you meet the deadlines can be done through effective self-management training. It can also be done by working well with other people from different disciplines, backgrounds, and expertise to accomplish a task or goal. In today's digital age, employers expect that the employees should be able to make use of elementary functions of information and communication technology to retrieve, access, store, produce, present and exchange information in collaborative networks via the Internet. Students need to develop entrepreneurial skills, so that they can develop necessary knowledge and skills to start their own business, thus becoming job creators rather than job seekers. Potential employees need to develop green skills, which are the technical skills, knowledge, values and attitudes needed in the workforce to develop and support sustainable social, economic and environmental outcomes in business, industry and the community. Thus, students are expected to acquire a range of skills so that you can meet the skill demands of the organisation that you would work for or to set up and run your own business.

This chapter is about employability skills, Constitutional values, becoming a professional in the 21st Century, digital, financial, and legal literacy, diversity and Inclusion, English and communication skills, customer service, entrepreneurship, and apprenticeship, getting ready for jobs and career development.

The scope covers the following :

- Introduction to Employability Skills
- Constitutional values – Citizenship
- Becoming a Professional in the 21st Century
- Basic English Skills
- Career Development & Goal Se?ng
- Communication Skills
- Diversity & Inclusion
- Financial and Legal Literacy
- Essential Digital Skills
- Entrepreneurship
- Customer Service
- Gettng ready for Apprenticeship & Jobs

The details of Employability module is available on eskill India. Please find below the link.

https://www.skillindiadigital.gov.in/content/list

Annexure-1

Annexure of QR Codes for Assistant False Ceiling and Drywall Installer

Chapter Name	Unit Name	Topic Name	URL	Page no.	QR Code
Chapter 1: Introduction to Scaffolding Occupation	Unit 1.1: Introduction to Scaffolding	Construction Industry	https://youtu.be/nndLyZrGfWc	12	Construction Industry
		Types of Construction	https://youtu.be/1WVzo2UFyo8		Types of Construction
		Scaffolding	https://youtu.be/96shGh3rfXw		Scaffolding
		Uses of Scaffold	https://youtu.be/5Vj-MosphpY		Uses of Scaffold
		Scaffolding Terms	https://youtu.be/TAGDIgRYcsc		Scaffolding Terms
	Unit 1.2 Role and Responsibilities of an Assistant Scaffolder- System	Role and Responsibilities of an Assistant Scaffolder - System	https://youtu.be/veF4uSUtrEY	17	Role and Responsibilities of an Assistant Scaffolder - System

Chapter Name	Unit Name	Topic Name	URL	Page no.	QR Code
Chapter 2: Erection and Dismantling of Scaffold Using Pipe and Coupler	Unit 2.1 - Erection and Dismantling of Scaffold Using Pipe and Coupler	Pipes and Couplers Scaffolding	https://youtu.be/-4tEehOJa-k	39	Pipes and Couplers Scaffolding
		Types of Couplers used in Scaffolding	https://youtu.be/PvapBkb2rzQ		Types of Couplers used in Scaffolding
		Types of Pipes used in Scaffolding	https://youtu.be/aL7zETeQEe0		Types of Pipes used in Scaffolding
		Materials, Tools and Equipment used in Pipe and Coupler Scaffolding	https://youtu.be/pktNG6YyMns		Materials, Tools and Equipment used in Pipe and Coupler Scaffolding
Chapter 3: Assist in the erection and dismantling of common customized system scaffold	Unit 3.1 Carry out preparatory works for erection of common customized system scaffold	Types of Scaffolds	https://youtu.be/e_2ZDfWLtN4	55	Types of Scaffolds

Chapter Name	Unit Name	Topic Name	URL	Page no.	QR Code
	Unit 3.2 Erect and maintain common customized system scaffold	Scaffolding Components	https://youtu.be/5Vj-MosphpY	68	Scaffolding Components
		Scaffolding Erection and Dismantle	https://youtu.be/OKawvyUhUkA		Scaffolding Erection and Dismantle
		Scaffolding Erection	https://youtu.be/0LS2COMYEk4		Scaffolding Erection
		Erecting Systems Scaffolds	https://youtu.be/oiglnKsQcoQ		Erecting Systems Scaffolds
		Safety Checks	https://youtu.be/AoDWOZE8Wb4		Safety Checks
	Unit 3.3 Dismantle common customized system scaffold	Dismantling the Scaffold	https://youtu.be/1gaFbGOazMg	72	Dismantling the Scaffold
		Hazards involved in Scaffolding	https://youtu.be/AoDWOZE8Wb4		Hazards involved in Scaffolding

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