Comprehensive Handbook on

Basic Scaffold Inspector and Employability Skills

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Acknowledgments

This Participant Handbook of the **Basic Scaffold Inspector** developed by the **Safety Skill Development Foundation (SSDF)**, provides essential information for current and prospective job holders. It reflects our collective commitment to fostering a culture of safety and equipping individuals in this role with the necessary skills to navigate and mitigate risks effectively. The content is compiled with valuable insights from Subject Matter Experts (SMEs) and industry professionals, ensuring its relevance and alignment with industry standards.

We extend our special thanks to **CORE-EHS Solutions Pvt Ltd** for their unwavering support & expertise in developing the course materials, which has significantly enhanced the quality and safety practices of this handbook. As our esteemed knowledge partner, CORE EHS has provided their invaluable expertise and insights to ensure the handbook is both practical and comprehensive, aligning with the highest safety and environmental standards.

We are grateful for the support of trainers, assessors, and industry experts who have enriched the content, ensuring it addresses the real-world needs of learners and fosters a culture of safety, health, and environmental consciousness.

We also acknowledge the support of all stakeholders, including government bodies, sector skill councils, and construction professionals, for their encouragement and commitment to advancing occupational safety and sustainable practices in the construction sector.

As the handbook is designed to support skill-based training, benefiting the participants, trainers, and evaluators. SSDF remains committed to uphold high-quality standards for QP/NOS-based training programs and welcomes suggestions from all stakeholders for future improvements.

Preface

Scaffolding has been used ever since man began making buildings more than one storey high and needed to find a practical way of working at height. Although the materials and designs have changed over the centuries, the purpose of scaffolding remains the same – to provide a safe, temporary access and platform from which all types of construction, repair and maintenance work can be carried out.

Stability and strength, along with compactness and of reasonable weight, become significant technological requirement. Before undertaking the construction of any scaffold, it's intended loading must be decided and all further steps and stages will commence thereafter.

Established practices, standards, rules, and regulations, mandatory provisions form essential factors to be taken into considerations. Inspection and certification for use, initially after the completion of the erection, and later for the proper up-keep and regular use, are also important requirements. Scaffolding offers a safer and more comfortable work arrangement compared to leaning over edges, stretching overhead and working from ladders. Suitable and sufficient scaffolding must be supplied for work at elevations that cannot be accomplished safely by other means. Properly erected and maintained, scaffolding provides workers safe access to work locations, level and stable working platforms, and temporary storage for tools and materials for performing immediate tasks.

This handbook is designed not only to provide a thorough grounding in the fundamental principles of scaffolding but also to align participants with current industry norms and innovative practices. As the field of scaffold management continues to advance, it is essential for professionals to stay updated with the latest regulations, technologies, and methodologies. This handbook serves as a bridge between traditional scaffold practices and modern, forward-thinking approaches that can be applied in diverse industrial settings.

By studying this material, participants will gain a deep understanding of the National Occupational Standards (NOS) relevant to their roles. Each

section is crafted to ensure that learners can comprehend, implement, and uphold the highest standards of safety within their workplaces. Beyond technical knowledge, this handbook also emphasizes the development of innovative skills that are crucial for navigating the complexities of today's industrial environments.

At SSDF, we believe that scaffold safety is a continuous learning process. This handbook is not just a guide for passing assessments but a resource that participants can refer to throughout their careers as scaffolding Inspector. It is our hope that this material will empower Scaffolding Inspector to contribute meaningfully to their organizations, ensuring that every worker can return home safely at the end of the day.

We are confident that the knowledge and skills gained from this handbook will not only enhance participants' professional capabilities but also foster a culture of safety and responsibility in their respective workplaces. As you embark on this learning journey, we encourage you to fully engage with the content, apply what you learn, and continuously strive for excellence in your role as a Basic Scaffold Inspector.

Welcome to the future of safety management.

Thank you.

J K Anand (Chairman)

Safety Skill Development Foundation (SSDF).

Contents

1. Introduction

Scaffolding is a temporary structure used to support people and materials in the construction or repair of buildings and other large installations. Commonly being highly raised means for work, safety becomes the main factor to care about.

The safe and efficient use of scaffolding depends first on choosing the right system for the job. If the scaffold's basic characteristics are un-matching to the task, or if all the necessary components are not available, personnel are forced to adopt make-shift arrangements and improvise. These unsafe conditions lead to accidents. Proper selection of scaffolding and related components requires basic knowledge about site conditions and the work to be done.

1.1. Purpose of the Handbook

This handbook has been meticulously developed by SSDF to serve as a comprehensive resource for individuals training to become Scaffold Inspector-Basic. The purpose of a basic scaffold inspector course is to equip individuals with the knowledge and skills necessary to conduct thorough and comprehensive inspections of complex scaffolding structures. This includes:

By incorporating basic scaffold inspector training into your company's safety protocols, you demonstrate a commitment to worker safety and a proactive approach to risk management.

Scope and Content

The content of this handbook is aligned with the National Occupational Standards (NOS) for the SSD/VSQ/Q0201 (Inspector-Basic Scaffold) . It covers a broad range of topics that are essential for effective scaffold management in various industrial settings. These include:

- **Enhanced Inspection Capabilities:** The course deepens participants' understanding of basic scaffolding systems, enabling them to identify potential hazards and safety risks in complex configurations.

- **Compliance with Regulations:** It ensures compliance with relevant safety regulations and industry standards, minimizing legal and financial liabilities.
- **Improved Decision-Making:** The course empowers inspectors to make informed decisions regarding scaffold safety and suitability for specific tasks.
- **Reduced Accidents:** By identifying and mitigating hazards proactively, the course contributes to a safer work environment, reducing the risk of accidents and injuries.
- **Enhanced Professionalism:** The certification obtained upon successful course completion enhances the professional standing of scaffold inspectors.
- **Employability Skills:** In addition to technical knowledge, the handbook also addresses the development of key employability skills, such as communication, teamwork, and digital literacy, which are essential for career success in the safety management field.

1.2. Learning Objectives

The primary objective of this handbook is to prepare participants for the responsibilities of Inspector-Basic Scaffold by providing them with a clear understanding of scaffolding, its types, technical specification of scaffold components, inspection criteria & national/international regulations. Upon successful completion of this course, participants will be able to:

- **Demonstrate a comprehensive understanding of basic scaffolding systems:** This includes in-depth knowledge of various types of scaffolds, their components, and their applications in complex construction scenarios.

- **Conduct thorough and systematic scaffold inspections:** Participants will learn to identify potential hazards, assess structural integrity, and evaluate compliance with relevant safety regulations and industry standards.

- **Interpret and apply relevant safety regulations and codes of practice**: This includes understanding and applying standards such as OSHA, BS, ANSI, and other relevant regional or national regulations.
- **Prepare and document comprehensive inspection reports:** Participants will be able to accurately document inspection findings, including observations, recommendations, and corrective actions.
- **Communicate effectively with stakeholders:** This includes communicating inspection findings and recommendations to site supervisors, project managers, and other relevant personnel.
- **Make informed decisions regarding scaffold safety and suitability:** Participants will be able to assess the suitability of scaffolds for specific tasks and make informed decisions regarding their use and maintenance.
- **Enhance their professional skills and knowledge:** The course will provide participants with the knowledge and skills necessary to advance their careers in the scaffolding industry.

1.3. Alignment with Industry Norms and Innovation

The industries are constantly evolving, with new technologies, processes, and regulations emerging regularly. This handbook not only teaches established knowledge and skills for the protection of workers, through effective scaffolding inspection, promoting safe scaffolding practices, and managing scaffold erection and dismantling. Whether it's understanding the latest advancements in scaffolding technology or learning how to implement new regulatory requirements, this handbook ensures that Basic Scaffold Inspectors are well-equipped to handle the demands of the modern construction industry.

1.4. Who Should Use This Handbook

This handbook is intended for anyone pursuing a career as a Scaffold Inspector involved in scaffold inspection and certification within industrial settings. It is particularly beneficial for:

Safety Managers and Coordinators: Individuals responsible for implementing and enforcing safety policies and procedures on industries, including those related to scaffolding.

Project Managers: Those involved in planning and managing construction projects & maintenance who need a comprehensive understanding of scaffold safety and inspection requirements.

Consultants and Engineers: Professionals involved in the design and evaluation of scaffolding systems.

Site Supervisors and Foremen: Professionals responsible for overseeing scaffold erection, dismantling and use.

1.5. How to Use This Handbook

Participants are encouraged to engage deeply with the content of this handbook, using it as both a study guide and a practical reference tool. Each section is designed to build on the previous one, leading to a comprehensive understanding of the Scaffold Inspector role. Practical exercises, case studies, and assessment guidelines are included to reinforce learning and provide real-world context. To get the most out of this handbook:

- Study each section thoroughly, taking the time to understand the key concepts and how they apply to real-world situations.
- Engage with the practical exercises and case studies to see how theoretical knowledge translates into practice.
- Refer to the assessment guidelines to prepare for evaluations and ensure you meet the required standards for certification.
- Use the additional resources section to explore further reading and deepen your understanding of complex topics.

1.6. The Path Forward

As you begin your journey to becoming a Scaffold Inspector, this handbook will be your essential guide. The knowledge and skills you gain through this course will not only help you excel in your assessments but also empower you to ensure the safety of workers at worksites. At SSDF, we are dedicated to supporting you throughout your learning process, and we are confident that with commitment and perseverance, you will emerge as a skilled and capable Scaffold Inspector, ready to tackle the challenges and responsibilities of this important role

2. Overview of this Program

The Scaffold Inspector course aims to provide participants with the essential knowledge and skills required for the safe inspection and management of scaffolding structures at work sites. The curriculum includes critical topics such as scaffold design and erection principles, hazard identification and risk assessment, relevant safety regulations and standards, and the proper documentation and reporting of inspection findings. Additionally, the course highlights the significance of risk reduction, adherence to safety regulations, and the facilitation of safe work practices to safeguard employees from scaffold-related hazards. Upon completion, attendees will be equipped to proficiently inspect and manage scaffolding and enhance safety within the work environment.

Key Responsibilities:

1. **Conduct thorough inspections:** Perform regular and comprehensive inspections of all scaffolding structures on site, including those under construction, in use, and during dismantling.
2. **Identify and assess hazards:** Identify potential hazards such as overloading, instability, inadequate bracing, and missing or damaged components.
3. **Assess structural integrity:** Evaluate the overall structural integrity of the scaffold, ensuring it can safely support the intended loads.
4. **Ensure compliance with regulations:** Verify compliance with all relevant safety regulations, standards, and best practices, including those from OSHA, ANSI, and local jurisdictions.
5. **Document inspection findings:** Prepare detailed inspection reports, including observations, photographs, and recommendations for corrective actions.
6. **Communicate effectively:** Clearly communicate inspection findings and recommendations to site supervisors, project managers, and other relevant personnel.
7. **Provide guidance and training:** Provide guidance and training to scaffold erectors and other workers on safe scaffolding practices.
8. **Investigate accidents and incidents:** Investigate any accidents or incidents involving scaffolds, identify root causes, and recommend corrective actions to prevent future occurrences.

9. **Stay updated on industry best practices:** Continuously update knowledge and skills on the latest advancements in scaffolding technology, safety regulations, and industry best practices.
10. **Promote a culture of safety:** Advocate for a strong safety culture on site, emphasizing the importance of safe scaffolding practices among all workers.

2.1. Job Description

Inspector (Basic Scaffold) is responsible for Inspection of Scaffolding and certify the compliances of scaffolding platform as per design, relevant specifications and ensure scaffolding safety for use for all scaffoldings including supported, mobile, cantilever, suspended scaffoldings. He/she is also responsible for advice on maintenance of documents, safe practices & compliances.

- Conduct thorough inspections of all scaffolding structures, including those under construction, in use, and during dismantling.
- Identify and assess potential hazards such as overloading, instability, inadequate bracing, and missing or damaged components.
- Evaluate the overall structural integrity of the scaffold, ensuring it can safely support the intended loads.
- Verify compliance with all relevant safety regulations, standards, and best practices, including those from OSHA, BS:EN, ANSI, and local jurisdictions.
- Prepare detailed inspection reports, including observations, photographs, and recommendations for corrective actions.
- Clearly communicate inspection findings and recommendations to site supervisors, project managers, and other relevant personnel.
- Provide guidance and training to scaffold erectors and other workers on safe scaffolding practices.
- Investigate any accidents or incidents involving scaffolds, identify root causes, and recommend corrective actions to prevent future occurrences.

- Continuously update knowledge and skills on the latest advancements in scaffolding technology, safety regulations, and industry best practices.
- Advocate for a strong safety culture on site, emphasizing the importance of safe scaffolding practices among all workers.

2.2. Personal Attributes

He/she should be physically & mentally fit and should be able to provide advice on the suitability of scaffolds to meet the health and safety requirements with regard to design and technical advice on scaffolding works and participate in work requiring higher level skills.

- **Safety-oriented:** A strong commitment to safety and a proactive approach to hazard identification.
- **Proactive:** Ability to identify and address potential problems before they occur.
- **Decisive:** Ability to make sound judgments and take appropriate action based on inspection findings.
- **Problem-solving:** Ability to effectively troubleshoot and resolve scaffolding-related issues.
- **Professionalism:** Maintain a professional and ethical demeanour at all times.
- **Teamwork:** Ability to effectively collaborate with other members of the construction team.

3. Qualification Parameters

Minimum Job Entry Age: 18 years

Minimum Educational Qualification & Experience:

- Completed 1st year of UG (UG Certificate) (in relevant field) with NA of experience (OR)
- Completed 1st year diploma after 12th with relevant field with NA of experience (OR)
- Completed 3 year diploma after 10th (in relevant field) with NA of experience (OR)
- Previous relevant Qualification of NSQF Level (4) with 1-2 Years of experience (1.5 Years)

Training Duration:

- For Regular Course- Duration: 570 hours
- For RPL- Duration: approximately 3 days

Mode of Training: Classroom instruction, practical exercises, and on-the-job training.

Qualification Levels:

NSQF Level: 4.5, aligned with the National Skill Qualifications Framework

4. Assessment Guidelines

Assessment Methods:

- Written Examinations: Multiple-choice questions, short-answer questions, and essay-type questions to test theoretical knowledge.
- Practical Assessments: Hands-on tasks to assess the ability to apply knowledge in real-world scenarios.

Grading System:

- Grade A (70% and above): Excellent performance, showing a strong understanding and application of safety protocols.
- Grade B (60% to 69%): Good performance, with a solid grasp of safety concepts and practical skills.
- Grade C (50% to 59%): Satisfactory performance, meeting basic requirements.
- Fail (Below 50%): Insufficient performance, requiring further study and re-assessment.

Re-assessment Opportunities:

- Trainees who fail can re-attempt the assessment in the next three months.
- Re-assessment focuses only on the failed NOS unless the overall score is below 50%, requiring a full re-assessment.

5. Glossary of Terms

Understanding the terminology used in occupational safety, health, and employability skills is crucial for effective communication and application of the principles covered in this handbook. The following glossary defines key terms that are frequently used in the field.

- Sector: An unexpected event that results in injury, illness, or damage to property Sector is a conglomeration of different business operations having similar business and interests. It may also be defined as a distinct subset of the economy whose components share similar characteristics and interests.
- Sub-sector: Sub-sector is derived from a further breakdown based on the characteristics and interests of its components.
- Occupation: Occupation is a set of job roles, which perform similar/ related set of functions in an industry.
- Job role: Job role defines a unique set of functions that together form a unique employment opportunity in an organisation.
- Occupational Standards (OS): OS specify the standards of performance an individual must achieve when carrying out a function in the workplace, together with the Knowledge and Understanding (KU) they need to meet that standard consistently. Occupational Standards are applicable both in the Indian and global contexts.
- Performance Criteria (PC): Performance Criteria (PC) are statements that together specify the standard of performance required when carrying out a task.
- National Occupational Standards (NOS): NOS are occupational standards which apply uniquely in the Indian context.
- Qualifications Pack (QP): QP comprises the set of OS, together with the educational, training and other criteria required to perform a job role. A QP is assigned a unique qualifications pack code.
- Unit Code: Unit code is a unique identifier for an Occupational Standard, which is denoted by an 'N'.
- Unit Title: Unit title gives a clear overall statement about what the incumbent should be able to do.

- Description: Description gives a short summary of the unit content. This would be helpful to anyone searching on a database to verify that this is the appropriate OS they are looking for.
- Scope: Scope is a set of statements specifying the range of variables that an individual may have to deal with in carrying out the function which have a critical impact on quality of performance required.
- Knowledge and Understanding (KU): Knowledge and Understanding (KU) are statements which together specify the technical, generic, professional and organisational specific knowledge that an individual need in order to perform to the required standard.
- Organisational Context: Organisational context includes the way the organisation is structured and how it operates, including the extent of operative knowledge managers have of their relevant areas of responsibility.
- Technical Knowledge: Technical knowledge is the specific knowledge needed to accomplish specific designated responsibilities.
- Core Skills/ Generic Skills (GS): Core skills or Generic Skills (GS) are a group of skills that are the key to learning and working in today's world. These skills are typically needed in any work environment in today's world. These skills are typically needed in any work environment. In the context of the OS, these include communication related skills that are applicable to most job roles.
- Electives: Electives are NOS/set of NOS that are identified by the sector as contributively to specialization in a job role. There may be multiple electives within a QP for each specialized job role. Trainees must select at least one elective for the successful completion of a QP with Electives.
- Options: Options are NOS/set of NOS that are identified by the sector as additional skills. There may be multiple options within a QP. It is not mandatory to select any of the options to complete a QP with Options.

6. Acronyms

Acronyms are often used to refer to key concepts, organizations, and regulations in the fields of occupational safety and employability skills. Below is a list of common acronyms used throughout this handbook:

- NOS: National Occupational Standards
- NSQF: National Skill Qualifications Framework
- QP: Qualifications Pack
- TVET: Technical and Vocational Education and Training
- RPL: Recognition Prior to Learning
- NCVET: National Council for Vocational Education and Training
- MSDE: Ministry of Skill Development and Entrepreneurship
- MEPSC: Management & Entrepreneurship and Professional Skills Council
- SSC: Sector Skill Council

7. National Occupational Standards (NOS)

National Occupational Standards (NOS) are a set of standards that describe the skills, knowledge, and competencies required to perform a specific job or task effectively in a industry. They are developed by industry experts and stakeholders, often in collaboration with government agencies or sector skills councils, to ensure that the workforce meets the industry's current and future needs.

Key Features of National Occupational Standards:

I. Competency-Based: NOS are designed around the competencies needed for specific job roles. They outline what a person should be able to do, know, and understand to perform their job effectively.

II. Industry-Specific: NOS are tailored to specific industries, ensuring that the skills and knowledge are relevant and up-to-date with the industry's practices, technologies, and regulatory requirements.

III. Standardization: By providing a consistent benchmark for skills and competencies, NOS help standardize the qualifications and training across an industry, making it easier for employers to identify qualified candidates and for workers to understand the expectations of their roles.

IV. Foundation for Qualifications: NOS often form the basis for developing vocational qualifications, training programs, and certification processes. For example, they are used to create National Vocational Qualifications (NVQs) or similar qualifications in other countries.

V. Guidance for Employers and Employees: Employers use NOS to develop job descriptions, assess employee performance, and design training programs. Employees can use NOS to understand the skills they need to develop for career progression.

VI. Support for Workforce Development: NOS are instrumental in workforce planning and development, helping industries ensure that their employees are skilled, competent, and able to meet the demands of their roles.

VII. Global Perspective: While the term "National Occupational Standards" is commonly used in countries like the UK and India, many other countries have similar frameworks, though they might use different terms (e.g., "Occupational Standards," "Competency Standards"). The goal remains the same: to create a skilled and competent workforce that can meet industry needs and support economic development.

7.1. NOS-1 SSD/VSQ/N0201.Scaffoldings & Specifications

7.1.1. Overview:

The NOS describes the knowledge & skills required by the professional to know & understand the types of scaffoldings, their components, specifications, uses under specific conditions and protections required for safe use.

7.1.2. Scope:

The scope of. SSD/VSQ/N0201 encompasses several critical aspects of scaffold standards, which include:

Identification of Scaffold & Components

- **Type of Scaffold:**
  - Identify the specific type of scaffold being used (e.g., independent tied, suspended, mobile, system scaffold).
  - Determine if it's a manufacturer-designed system or a custom-built scaffold.
- **Components:**
  - Identify and inspect all components, including Standards (vertical members), Ledgers (horizontal members), Transoms (horizontal members supporting platforms), Braces (diagonal members for stability), Base plates/mud sills, Couplers/connectors, Platforms/planks, Guardrails, mid-rails, and toeboards, Ladders/stairways, Castors/wheels (if applicable), any other accessories (e.g., outriggers, tie-backs)

Design Load Calculation of the Scaffold

- **Determine Intended Loads:**
  - Calculate the anticipated loads on the scaffold, including
    - **Dead Load:** Weight of the scaffold itself (standards, ledgers, platforms, etc.)

        - **Live Load:** Weight of workers, materials, tools, and equipment.
        - **Impact Load:** Potential for sudden or dynamic loads (e.g., dropped tools).
        - **Environmental Loads:** Wind, snow, ice (if applicable).
- **Structural Capacity:**
    - Ensure the scaffold's design and construction can safely support the calculated loads.
    - Consider factors like:
        - Material strength of components
        - Spacing of standards and ledgers
        - Bracing configurations
        - Ground conditions (if applicable)
- **Load Calculations:**
    - Utilize appropriate engineering principles and calculations to determine safe working loads for the scaffold.
    - Consider factors like span, height, and loading distribution.

Fall Protection Requirements & Provisions in the Scaffold

- **Fall Protection Plan:**
    - Develop and implement a fall protection plan that addresses potential fall hazards.
    - Consider options like:

      Guardrail Systems:
        - Install guardrails, mid-rails, and toeboards around all open sides and edges of platforms.
        - Ensure proper height and spacing of guardrail components.

      Personal Fall Arrest Systems (PFAS):
        - Utilize PFAS (e.g., harnesses, lifelines, anchor points) when guardrails are not feasible or when workers are positioned where they could fall through openings.
        - Ensure proper selection, inspection, and use of PFAS.

Safety Nets:

- Install safety nets beneath work areas where the risk of a fall to a lower level exists.

Fall Restraint Systems:

- Utilize fall restraint systems to prevent workers from reaching areas where they could fall.

- **Access and Egress:**
  - Provide safe access and egress to all levels of the scaffold using ladders, stairways, or other safe means.
  - Ensure ladders and stairways are properly secured and maintained.
- **Inspections:**
  - Regularly inspect fall protection systems to ensure they are in good working order and properly installed.

The key learning objectives include:

Upon successful completion of this learning module, participants will be able to:

- Understand Scaffolding Fundamentals
- Interpret Scaffolding Drawings and Specifications
- Apply Load Calculations and Design Principles
- Evaluate Scaffolding Safety
- Document and Communicate Findings
- Understand Scaffolding Maintenance and Dismantling
- Enhance Professional Skills

By achieving these learning objectives, participants will gain a comprehensive understanding of scaffolding principles, specifications, and safety requirements, enabling them to contribute to the safe and efficient execution.

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Performance Criteria: To effectively meet the goals of SSD/VSQ/N0201, individuals are expected to demonstrate competency in the following areas:

7.1.3. Types of Scaffoldings

PC1. Identification of several types of scaffolds, their components

- **Common Types of Scaffolds:**
  - **Independent Tied:** Most common, freestanding, relies on its own structure for stability.
  - **Suspended:** Hangs from the structure being worked on, often used for high-rise buildings.
  - **Mobile:** Mounted on wheels or casters for easy movement.
  - **System Scaffolds:** Use prefabricated components for faster assembly, like Ring lock, Cup lock, Tube & Coupler.
  - **Cantilever:** Extends horizontally beyond the support structure.
- **Key Components:**
  - **Standards:** Vertical members forming the scaffold's frame.
  - **Ledgers:** Horizontal members connecting standards.
  - **Transoms:** Horizontal members supporting the platform.
  - **Braces:** Diagonal members for stability.
  - **Base Plates:** Support the standards on the ground.
  - **Couplers:** Connect tubes together.
  - **Platforms/Planks:** Working surfaces.
  - **Guardrails, Mid-rails, Toeboards:** Fall protection systems.
  - **Ladders/Stairways:** Access to different levels.

PC2. Determination of type of scaffold required as per site & load requirements

- **Site Conditions:**
  - Height of the work area.
  - Access to the work area.
  - Ground conditions (stable, uneven).
  - Surrounding environment (wind, weather).
  - Proximity to obstructions.
- **Load Requirements:**
  - Weight of workers, materials, and equipment.
  - Frequency and intensity of loading.

- Any potential impact loads.

PC3. Identification of working & faulty components and defects in the components

- **Working Components:**
  - Components that are in good condition, free from defects, and suitable for use.
  - Properly installed and connected.
  - Meet all safety requirements.
- **Faulty Components:**
  - Components that are damaged, worn, or otherwise not fit for use.
  - Examples:
    - Bent or twisted standards.
    - Cracked or broken ledgers or transoms.
    - Missing or damaged couplers.
    - Rotting or damaged wood planks.
    - Loose or missing guardrail components.
- **Common Defects:**
  - **Corrosion:** Rust, pitting, or other forms of metal degradation.
  - **Deformation:** Bending, twisting, or other distortions.
  - **Cracks and Breaks:** Fractures in the material.
  - **Wear and Tear:** Excessive wear on contact points.
  - **Improper Assembly:** Incorrect connections or missing components.

7.1.4. Design Load Calculation

PC4. Calculation of load on scaffold & optimum load

- **Determine all potential loads:**
  - **Dead Load:** Weight of the scaffold itself (standards, ledgers, platforms, etc.)
  - **Live Load:** Weight of workers, materials, tools, and equipment.
    - This can vary greatly depending on the specific task (e.g., bricklaying vs. heavy equipment).
  - **Impact Load:** Potential for sudden or dynamic loads (e.g., dropped tools, sudden movements).

    - **Environmental Loads:** Wind, snow, ice (if applicable).
- **Calculate Total Load:** Sum of all the above loads to determine the maximum anticipated load on the scaffold.
    - **Determine Optimum Load:** This refers to the safe working load for the scaffold, which should be significantly lower than the ultimate load capacity to ensure a safety factor.

PC5. Calculation of design load for the scaffold

- **Consider Material Strengths:** Determine the load-bearing capacity of the scaffold materials (e.g., steel, aluminium).
- **Structural Analysis:** Analyze the scaffold's structural integrity, considering factors like:
    - Spacing of standards and ledgers.
    - Bracing configurations.
    - Connections between components.
    - Ground conditions (if stable).
- **Calculate Safe Working Loads:** Determine the maximum loads that the scaffold can safely support without exceeding its design limits. This involves engineering calculations and may require the assistance of qualified professionals.

PC6. Working requirements of components, tie-offs, supports etc. of the scaffoldings as per design requirement

- **Component Selection:** Ensure that all components (standards, ledgers, couplers, etc.) are appropriately sized and rated to withstand the calculated design loads.
- **Tie-Off Requirements:**
    - Determine the appropriate type and number of tie-offs (if required) to ensure the scaffold's stability.
    - Consider factors like wind loads, ground conditions, and the height of the scaffold.
- **Support Requirements:**
    - Ensure adequate support for the scaffold at ground level.
    - Consider factors like ground stability, soil conditions, and the use of base plates or mud sills.

7.1.5. Fall Protection Requirements

PC7. Identification of types of fall protection for the scaffolds, tie-offs, supports, and ladders.

- **Guardrail Systems:**
  - Standard guardrails, mid rails, and toeboards.
  - Important for preventing falls over the edges of platforms.
- **Personal Fall Arrest Systems (PFAS):**
  - Harnesses, lifelines, and anchor points.
  - Used when guardrails are not feasible or when workers are positioned where they could fall through openings.
- **Safety Nets:**
  - Installed beneath work areas to catch falling workers.
- **Fall Restraint Systems:**
  - Prevent workers from reaching areas where they could fall.

PC8. Working out of fall protections required in the scaffold for various activities and effectiveness.

- **Assess Fall Hazards:** Identify all potential fall hazards associated with each specific work activity on the scaffold.
- **Select Appropriate Fall Protection:** Choose the most suitable fall protection system for each hazard based on factors such as:
  - Height of the work area.
  - Type of work being performed.
  - Access and egress requirements.
  - Worker mobility needs.
- **Ensure Proper Installation and Use:**
  - Ensure that all fall protection systems are properly installed, inspected, and used according to manufacturer's instructions and safety regulations.
  - Provide training to workers on the proper use and limitations of fall protection equipment.
- **Evaluate Effectiveness:** Regularly assess the effectiveness of fall protection systems and make adjustments as needed.

By understanding and applying these principles, individuals can ensure the safe design, erection, and use of scaffolding systems, minimizing the risk of falls and other accidents.

7.1.6. Assessment Criteria:

The assessment for NOS 01 is divided into theoretical and practical components, ensuring that learners are evaluated on both their knowledge and their ability to apply that knowledge in real-world scenarios:

- **Theory (50 Marks):**

A Scaffold Inspector ensures the safety and stability of scaffolding structures on construction sites. They conduct thorough inspections, identify hazards, assess structural integrity, and ensure compliance with safety regulations.

- **Practical (50 Marks):**

The practical assessment in a Scaffold Inspector course evaluates a trainee's ability to apply their classroom learning to real-world scenarios. It involves hands-on activities like inspecting actual scaffolds, identifying hazards, assessing fall protection, and documenting findings. This ensures they can effectively and safely inspect and manage scaffolding.

NOS 01-SSD/VSQ/N0201: The National Occupational Standards (NOS) for Scaffolding define the essential knowledge and skills needed by professionals in the field. This includes understanding different scaffold types, their components, specifications, safe use practices, and the implementation of appropriate fall protection measures.

7.2. NOS 02: SSD/VSQ/N0203: Scaffolding Drawings and Designs

7.2.1. Overview:

The NOS describes the knowledge & skills required by the professional to know & understand the scaffolding drawings, code provisions in designing, design factors, load calculations and design of supported scaffoldings up to a height of 20 meters.

7.2.2. Scope:

The scope of SSD/VSQ/N0203 includes the following key areas:

- **Reading & Understanding Scaffold Drawings:**
  - This involves the ability to interpret engineering drawings and specifications for scaffolding systems.
  - This includes understanding symbols, dimensions, and the intended configuration of the scaffold.
- **Scaffold Requirement & Design of Supported Scaffold up to 20-meter Height:**
  - This focuses on the practical aspects of designing and planning a supported scaffold (likely independent tied) for heights up to 20 meters.
  - This includes considering factors like load capacity, ground conditions, wind loads, and access requirements.
- **Identification of Fall Protection & Design:**
  - This emphasizes the crucial aspect of fall protection.
  - It requires the ability to identify potential fall hazards and select and design appropriate fall protection systems, such as guardrails, mid rails, toeboards, and personal fall arrest systems (PFAS).

This scope defines a core set of knowledge and skills related to the design and planning of supported scaffolds up to a specific height, with a strong emphasis on safety and fall protection.

Performance Criteria: To effectively meet the standards of SSD/VSQ/N0203, learners are expected to demonstrate competency in the following areas:

7.2.3. Scaffold Drawing & Details

PC1. Reading and understanding of scaffold drawings.

- This involves the ability to interpret engineering drawings and specifications for scaffolding systems.
- Understand symbols, notations, dimensions, and the intended configuration of the scaffold.

- Identify components (standards, ledgers, transoms, braces, etc.) and their placement on the drawings.

PC2. Interpretations of scaffold drawings.

- Translate the drawings into a clear understanding of the required scaffold structure.
- Visualize the assembled scaffold based on the drawings.
- Identify any potential discrepancies or inconsistencies in the drawings.

PC3. Aid in preparations of Scaffold drawings.

- Collaborate with engineers or designers to develop scaffold drawings.
- Gather necessary information and measurements for the drawings.
- Assist in the creation of accurate and detailed drawings.

7.2.4. Scaffold Design

PC4. Working out of design details of scaffolds as per Indian Standards for supported & mobile scaffoldings up to 20 meters height.

- Design scaffold systems that comply with Indian Standards (IS codes) for supported and mobile scaffolds.
- Consider factors like load capacity, wind loads, ground conditions, and access requirements.
- Ensure the design is safe, stable, and efficient.

PC5. Working out of design details of scaffold as per International Standards of OSHA & BS standards for supported & mobile scaffoldings up to 20 meters height.

- Design scaffold systems that comply with international standards like OSHA (Occupational Safety and Health Administration) and BS (British Standards).
- Understand the specific requirements and guidelines of these standards.
- Adapt designs to meet the requirements of different international standards.

PC6. Checking of design details of scaffolds provided to him.

- Review scaffold designs prepared by others.

- Identify any potential errors, omissions, or non-conformances with relevant standards.
- Ensure the design is safe, feasible, and meets the project requirements.

7.2.5. Fall Protection Requirements

PC7. Working out details of fall protections, design and fall protection measures.

- Design and implement appropriate fall protection systems, such as:
    - Guardrail systems (including mid rails and toeboards)
    - Personal Fall Arrest Systems (PFAS)
    - Safety nets
    - Fall restraint systems

  Consider factors like the height of the work area, the type of work being performed, and the potential fall hazards.

PC8. Working out details of ladder/temporary ladder requirements & design.

- Design and implement safe access and egress to all levels of the scaffold using ladders or temporary stairways.
- Ensure ladders are properly secured, have appropriate lengths, and are in good condition.
- Consider factors like ladder angle, handrail requirements, and safe access points.

7.2.6. Assessment Criteria:

The assessment for NOS 02 is divided into theoretical and practical components, ensuring that learners are evaluated on both their knowledge and their ability to apply that knowledge in real-world scenarios:

- **Theory (50 Marks):**

The assessment of theory session in a Scaffold Inspector course provides the foundation for understanding scaffolding principles, design standards, and fall protection.

- **Practical (50 Marks):**

The practical assessment evaluates the trainee's ability to apply this knowledge by reading and interpreting scaffold drawings, designing simple

scaffold structures, selecting appropriate fall protection systems, ensuring designs comply with relevant standards.

NOS 02-SSD/VSQ/N0203: The National Occupational Standards (NOS) for scaffolding outline the essential knowledge and skills for professionals, including reading and understanding scaffold drawings, adhering to design codes and standards, considering design factors like load and ground conditions.

7.3. NOS 3: SSD/VSQ/N0204: Safety, Inspection and Documentation

7.3.1. Overview:

The NOS describes the knowledge & skills required by the professional for ensuring compliance of design, safety of scaffolding platform, process to be followed & documentation to be maintained during & after the inspection process of the scaffolds.

7.3.2. Scope:

The scope of SSD/VSQ/N0204 includes the following key areas:

Safety & Design Check during Inspection:

- This emphasizes the proactive role of the inspector in identifying and mitigating potential hazards during both the erection and use of the scaffold.
- This includes:
    - Identifying any deviations from the approved design.
    - Assessing the stability and structural integrity of the erected scaffold.
    - Checking for any signs of overloading or misuse.
    - Ensuring the proper installation and functioning of fall protection systems.

Inspection of scaffold after erection before opening for use:

- This highlights the importance of a final, thorough inspection before the scaffold is put into use.
- This inspection is crucial to ensure that the scaffold is safe and ready for workers to access.

Documents to be prepared and maintained in scaffold inspection:

- This emphasizes the importance of proper documentation for record-keeping and accountability.
- This may include:
    - **Inspection checklists:** Standardized forms to ensure consistent and thorough inspections.
    - **Inspection reports:** Detailed reports documenting the findings of each inspection, including any deficiencies or corrective actions required.
    - **Photographs:** Visual documentation of the scaffold and any identified issues.
    - **Maintenance records:** Records of any repairs or modifications made to the scaffold.

Performance Criteria: To effectively meet the standards of SSD/VSQ/N0204, learners are expected to demonstrate competency in the following areas:

7.3.3. Safety and Design Check

PC1. Checking whether the scaffold is as per design & drawings.

- This involves comparing the erected scaffold to the approved design drawings and specifications.
- Verify that the actual construction matches the intended design in terms of:
    - Dimensions (height, width, length)
    - Component types and sizes (standards, ledgers, transoms, etc.)
    - Bracing configurations
    - Platform sizes and locations
    - Tie-in points and anchorage systems

PC2. Checking Safety measures provided in scaffold preparation as per design & drawings.

- Verify the proper installation and functioning of all safety measures, including:
    - Guardrails, mid rails, and toeboards
    - Fall protection systems (PFAS)
    - Access and egress points (ladders, stairways)
    - Tie-backs and bracing systems
    - Ground support and stability

PC3. Briefing & display for proper uses of scaffold to users.

- Communicate the safe use procedures for the scaffold to workers.
- Provide clear instructions on accessing, working on, and exiting the scaffold.
- Display clear signage and instructions on the scaffold regarding safe work practices and load limits.

7.3.4. Inspection Process

PC4. Follow the step wise process of Inspection.

- Adhere to a systematic inspection procedure, such as:
    - Visual inspection of all components.
    - Checking for signs of wear, tear, or damage.
    - Assessing the stability and rigidity of the structure.
    - Verifying the proper installation and functioning of all safety systems.
- Ensure a thorough and consistent inspection process.

PC5. Checking each of the inspection points of the scaffold.

- Inspect all critical points of the scaffold, including:
    - All connections between components.
    - Base plates and ground support.
    - Bracing and tie-in points.
    - Platforms and decking.
    - Guardrails, mid rails, and toeboards.
    - Access and egress points.

PC6. Compliances of all inspection points & prepare inspection report.

- Document all findings during the inspection, including any deficiencies or non-conformances.
- Prepare a detailed inspection report that includes:
    - Date and time of inspection
    - Location of the scaffold
    - Name of the inspector
    - Observations and findings
    - Photographs of any deficiencies
    - Recommendations for corrective actions

7.3.5. Documentation

PC7. Preparation & maintenance of documents as per inspection process.

- Maintain accurate and up-to-date inspection records.
- Store inspection reports in a secure and organized manner for future reference.

PC8. Providing the inspection report to concerned officials.

- Submit inspection reports to the site supervisor, project manager, and other relevant personnel.

- Communicate any safety concerns or deficiencies to the appropriate parties.

7.3.6. Assessment Criteria:

The assessment for NOS 03 is divided into theoretical and practical components, ensuring that learners are evaluated on both their knowledge and their ability to apply that knowledge in real-world scenarios:

- **Theory (50 Marks):**

Provides in-depth understanding of basic scaffolding systems, design principles, relevant standards (like OSHA, ANSI, and local codes), and basic inspection techniques.

- **Practical (50 Marks):**

Evaluates basic skills through assessing the ability to conduct thorough inspections of complex scaffolds, including suspended, cantilevered, and multi-tiered systems, Identify critical hazards by recognize subtle safety issues and potential risks. Prepare detailed reports by accurately document inspection findings, including photographs and detailed descriptions of any deficiencies.

NOS 03-SSD/VSQ/N0204: The NOS for Scaffolding outlines the essential knowledge and skills for professionals to ensure Safe and compliant scaffold design, stable scaffolding platforms, thorough inspection and maintenance, accurate documentation of all inspections.

7.4. NOS 4: SSD/VSQ/N0205: International Practices and Designs in Scaffoldings

7.4.1. Overview:

The NOS describes the knowledge & skills required by the professionals about the international practices in drawings, designs of scaffolds and various codes provisions followed in designing of scaffolds, specifications given.

7.4.2. Scope:

The scope of SSD/VSQ/N0205 includes the following key areas:

International Practices in Design of Scaffolds:

- This encompasses knowledge of internationally recognized best practices and standards for scaffold design.
- It includes understanding different design philosophies, approaches, and methodologies employed in different countries and regions.
- This might involve studying case studies of successful and innovative scaffold designs from around the world.

International Standards, Codes & Drawings in Scaffolding:

- This focuses on the specific standards, codes, and guidelines relevant to scaffold design and use in different countries.
- Examples include:
    - OSHA (Occupational Safety and Health Administration) standards in the US.
    - BS (British Standards) in the UK.
    - ISO (International Organization for Standardization) standards.
    - National standards from various countries.
- Understanding how these standards and codes translate into specific design requirements and best practices.

- Ability to interpret and apply international standards to specific scaffold design and inspection scenarios.
- Familiarity with common symbols, notations, and conventions used in international scaffolding drawings.

Inspection & Documents Preparation in Inspection:

This emphasizes the importance of thorough and documented inspections.

- **Inspection Procedures:** Following internationally recognized inspection procedures and checklists.
- **Documentation:**
    - Preparing comprehensive inspection reports that adhere to international standards.
    - Maintaining accurate records of all inspections, including photographs and any identified deficiencies.
    - Ensuring proper documentation and reporting for compliance with international regulations.

Performance Criteria: To effectively meet the standards of SSD/VSQ/N0205, learners are expected to demonstrate competency in the following areas:

7.4.1. Standards and Design of Scaffolds

PC1. Basic working of design details of scaffold as per following international codes and practices.

- Understand the fundamental principles of scaffold design outlined in these standards:
    - **BS EN-12810, 11, 12, EN 74 (European Standards):** Cover various aspects of scaffolding, including design, erection, inspection, and dismantling.

- **NASC - TG20-13 (National Access & Scaffolding Confederation, UK):** Provides guidance on safe scaffolding practices.
- **SG4-10, SG6 (Singapore Standards):** Specific to scaffolding requirements and practices in Singapore.
- **OSHA, USA (29 CFR 1926.451):** Outlines OSHA regulations for scaffolding in the United States.
- Be able to apply the basic principles of these standards to design and evaluate scaffold systems.

PC2. International best practices followed in following countries or regions and industry standards.

- Understand the common practices and industry standards for scaffold design in different regions:
  - **UK or Europe:** Familiar with European standards and best practices, including those related to system scaffolds and mobile towers.
  - **USA:** Understand OSHA regulations and common practices in the US construction industry.
  - **Australia:** Familiar with Australian Standards and best practices for scaffold design and erection.
  - **Gulf Countries:** Understand the specific challenges and requirements for scaffolding in hot and arid climates.

PC3. Checking of design details of scaffold as per international design standards.

- Review scaffold designs to ensure compliance with relevant international standards (e.g., BS, OSHA, Australian Standards).
- Identify any deviations from the standards and assess their potential impact on safety.
- Recommend necessary modifications to ensure compliance and improve safety.

7.4.2. Drawings and International Practices

PC4. Read, understand, and interpret the international scaffold drawings.

- Be able to read and interpret scaffold drawings prepared according to international standards and conventions.
- Understand the symbols, notations, and conventions used in different countries or regions.
- Visualize the assembled scaffold based on the drawings.

PC5. Helping in preparations of Scaffold drawings as per international convention and practices.

- Assist in the preparation of scaffold drawings that comply with international standards and best practices.
- Ensure that drawings are clear, concise, and easy to understand.
- Incorporate appropriate symbols, notations, and dimensions.

7.4.3. Inspection and Documents Preparation

PC6. Preparation and carry out inspection as per concerned codes and practices.

- Conduct scaffold inspections in accordance with relevant international standards and codes of practice.
- Follow established inspection procedures and checklists.
- Identify and document any deficiencies or non-conformances.

PC7. Preparation of documents as per practice in concerned region and reporting.

- Prepare inspection reports that comply with the documentation requirements of the relevant region or country.
- Ensure that reports are clear, concise, and accurately reflect the findings of the inspection.

- Submit reports to the appropriate authorities as required by local regulations.

7.4.4. Assessment Criteria:

The assessment for NOS 04 is divided into theoretical and practical components, ensuring that learners are evaluated on both their knowledge and their ability to apply that knowledge in real-world scenarios:

- **Theory (50 Marks):**

The theory session provides a foundation in international scaffolding standards, design principles, and best practices.

- **Practical (50 Marks):**

The practical assessment evaluates the ability to analyze designs based on international standards, identify hazards specific to international standards, propose design modifications to meet international requirements.

NOS 04-SSD/VSQ/N0205: The NOS for Scaffolding ensures professionals have the knowledge and skills to understand international scaffolding practices, interpret international drawings and specifications, adhere to international design codes and standards. This ensures safe and effective scaffolding practices globally.

7.5. NOS 5: SSD/VSQ/N0210: Plan, Organize & Monitor

7.5.1. Overview:

The NOS describes the knowledge & skills required by the professionals about the international practices in drawings, designs of scaffolds and various codes provisions followed in designing of scaffolds, specifications given.

7.5.2. Scope:

The scope of SSD/VSQ/N0210 includes the following key areas:

Planning of resources for own work and communication to concerned subordinates, co-workers, and superiors.

- **Resource Planning:** This involves effectively planning and allocating resources for individual tasks and projects.
    - This includes identifying and acquiring necessary tools, equipment, materials, and personnel.
    - It also involves estimating time and budget requirements for the task or project.
- **Communication:**
    - Clear and effective communication is crucial for successful project execution.
    - This includes:
        - Communicating resource needs and plans to subordinate.
        - Coordinating with co-workers to ensure smooth workflow and avoid conflicts.
        - Keeping superiors informed about project progress, challenges, and any necessary adjustments.

Provide necessary support to subordinates, co-ordinate with co-workers and consult with superiors and other teams.

- **Subordinate Support:** This involves providing guidance, training, and support to subordinates to ensure they can effectively perform their tasks.
- **Teamwork and Coordination:**
    - Effective collaboration with co-workers is essential for successful project completion.
    - This includes coordinating work schedules, sharing information, and resolving any inter-team conflicts.
- **Consultation and Collaboration:**

- Consulting with superiors for guidance and approval on important decisions.
- Collaborating with other teams (e.g., engineering, procurement) to ensure smooth project execution.

Monitor progress of work and adjust, manage, or project requirements on time.

- **Progress Monitoring:**
  - Continuously monitor the progress of work against the planned schedule and budget.
  - Identify any potential delays or roadblocks.
- **Adjustments and Management:**
  - Take corrective actions to address any deviations from the plan.
  - Adjust project plans and schedules as needed to accommodate unforeseen circumstances.
  - Manage any changes to project requirements effectively.
- **On-Time Delivery:**
  - Ensure that the project is completed within the specified time frame and budget constraints.

Performance Criteria: To effectively meet the standards of SSD/VSQ/N0210, learners are expected to demonstrate competency in the following areas:

7.5.3. Planning of Work

PC1. Planning of resources, schedules, and timelines as per work timelines given by superiors.

- This involves effectively planning and scheduling work activities within the given timelines provided by supervisors.
- It requires identifying and acquiring necessary resources such as materials, equipment, and personnel.
- Creating detailed schedules and timelines for each task or project phase.

PC2. Communicating to concerned co-workers & superiors.

- Clear and effective communication is crucial. This includes:
    - Informing co-workers about work schedules, deadlines, and potential roadblocks.
    - Keeping superiors updated on progress, challenges, and any necessary adjustments to the plan.
    - Coordinating with other departments or teams to ensure smooth workflow.

PC3. Tasking to subordinates as per task & timelines.

- Assigning tasks to subordinates clearly and concisely.
- Providing necessary instructions, guidance, and support to subordinates.
- Setting clear deadlines and expectations for each assigned task.

7.5.4. Organizing of Work

PC4. Resource collection and provisioning.

- Ensuring that all necessary resources are available when needed.
- This includes procuring materials, equipment, and securing the necessary personnel.
- Managing the flow of resources efficiently to avoid delays.

PC5. Understanding hierarchy of the organization and communicating to concerned co-workers & superiors.

- Understanding the organizational structure and reporting lines.
- Communicating appropriately with co-workers, supervisors, and other relevant personnel based on their roles and responsibilities.

PC6. Briefing to subordinates about the schedule, sequence, timing & resources to subordinates.

- Providing clear and concise briefings to subordinates about the project schedule, work sequence, timelines, and the resources available to them.
- Addressing any questions or concerns raised by subordinates.

7.5.5. Monitoring of Work

PC7. Monitoring progress of work, management of resources, guidance to subordinates.

- Continuously monitoring the progress of work against the established schedule.
- Tracking the utilization of resources and making adjustments as needed.
- Providing guidance and support to subordinates to overcome challenges and stay on track.

PC8. Reporting to superiors and keeping the other teams informed.

- Regularly updating superiors on project progress, including any deviations from the plan.
- Communicating with other teams to coordinate work activities and resolve any inter-team issues.

PC9. Documentations & compliances and report submission.

- Maintaining accurate records of project progress, resource utilization, and any issues encountered.
- Preparing and submitting timely reports to superiors and other stakeholders.
- Ensuring compliance with all relevant project requirements and deadlines.

7.5.6. Assessment Criteria:

The assessment for NOS 05 is divided into theoretical and practical components, ensuring that learners are evaluated on both their knowledge and their ability to apply that knowledge in real-world scenarios:

- **Theory (50 Marks):**

Assesses the learner's understanding of resource planning, communication strategies, and the principles of monitoring protocols. This includes knowledge of setting up and maintaining effective planning & monitoring plans.

- **Practical (50 Marks):**

Evaluates the learner's ability to plan, organize & monitor thorough timelines, schedules & communication.

NOS 05-SSD/VSQ/N0210: Plan, Organize, and Monitor (SSD/N0210) provides a comprehensive framework for ensuring that work activities are safely planned and organized, with robust emergency protocols in place to manage unforeseen incidents. By focusing on resource planning, effective communication, and emergency preparedness, this standard equips individuals with the tools needed to maintain a safe work environment and

respond effectively to emergencies. Adhering to this standard not only enhances workplace safety but also ensures compliance with safety regulations and promotes a proactive safety culture within the organization.

7.6. NOS 6: SSD/VSQ/N0206: Work with Safety, Health and Environment

7.6.1. Overview:

The NOS describes the knowledge and skills required by the professionals to ensure personal and coworker safety, health & environmental protocols and measures while carrying out work or inspection.

7.6.2. Scope:

The scope of SSD/VSQ/N0206 includes the following key areas:

Safety Measures to minimize any incident or accidents, use of personal safety equipment and emergency drills.

- **Safety Measures:** This encompasses a wide range of safety practices aimed at preventing accidents and injuries in the workplace.
    - This includes identifying and mitigating potential hazards, implementing safety procedures, and ensuring compliance with safety regulations.
- **Personal Safety Equipment (PPE):**
    - Ensuring the proper use and maintenance of PPE, such as safety helmets, safety shoes, gloves, eye protection, and hearing protection.
    - Training employees on the correct use and selection of PPE for different tasks.
- **Emergency Drills:**
    - Conducting regular emergency drills (fire drills, evacuation drills) to prepare employees for potential emergencies.
    - Ensuring that all employees are familiar with emergency procedures and their roles in an emergency situation.

Healthy habits, maintenance of clean and healthy area and healthy working relation among co-workers and subordinate.

- **Healthy Habits:** Promoting healthy habits among employees, such as:
    - Encouraging regular breaks and physical activity.
    - Promoting healthy eating habits.
    - Addressing issues like stress and burnout.
- **Clean and Healthy Work Environment:**
    - Maintaining a clean and organized workplace.
    - Ensuring adequate ventilation and lighting.
    - Implementing measures to control noise and other environmental hazards.
- **Healthy Working Relationships:**
    - Fostering a positive and respectful work environment.
    - Promoting open communication and teamwork among colleagues.
    - Addressing workplace conflicts constructively.

Safe disposal of waste materials to minimize adverse effect on environment and reuse.

- **Waste Management:** Implementing proper waste management procedures, including:
    - Segregation of waste into different categories (e.g., recyclable, non-recyclable, hazardous).
    - Proper disposal of waste materials in accordance with environmental regulations.
    - Minimizing waste generation through efficient resource utilization and recycling programs.

- **Environmental Protection:**
    - Reducing the environmental impact of workplace activities.
    - Implementing measures to conserve energy and water.
    - Promoting the use of environmentally friendly products and materials.

Performance Criteria: To effectively meet the standards of SSD/VSQ/N0206, learners are expected to demonstrate competency in the following areas:

7.6.3. Safety Measures to minimize incidents or accidents at workplace

PC1. Identification of risks & hazards and emergency protocols at work site.

- Identify potential hazards in the workplace, such as electrical hazards, fire hazards, chemical hazards, and ergonomic hazards.
- Understand and be able to implement emergency protocols in case of accidents, fires, or other emergencies.

PC2. Emergency evacuations processes in case of accidents, fires, or emergencies.

- Know and understand the emergency evacuation procedures for the workplace.
- Be able to assist in the safe and orderly evacuation of personnel in case of an emergency.

PC3. Use of Personal Protective Equipment by self & subordinates/co-workers.

- Ensure that all personnel are using the appropriate personal protective equipment (PPE) for their tasks, such as safety helmets, safety shoes, gloves, eye protection, and hearing protection.

- Monitor the use of PPE by subordinates and ensure they are properly trained and equipped.

PC4. Storing & handling of tools, equipment & materials as per safety guidelines.

- Store and handle tools, equipment, and materials safely to prevent accidents and injuries.
- Follow proper storage procedures to prevent damage, theft, and unauthorized use.
- Ensure that all tools and equipment are properly maintained and in good working condition.

7.6.4. Health of personnel & Work environment

PC5. Identification of health hazards issues and area at work site.

- Identify potential health hazards in the workplace, such as exposure to hazardous chemicals, noise, dust, and poor ventilation.

PC6. Ensuring of healthy and working area free from health hazards.

- Take steps to minimize exposure to health hazards, such as implementing proper ventilation, providing adequate lighting, and maintaining a clean and organized work environment.

PC7. Use of earmarked sanitation area & facilities.

- Ensure that all employees have access to clean and hygienic sanitation facilities, such as restrooms and handwashing stations.

PC8. Ensuring good personal hygiene, sanitation habits, cleanliness, and safe disposal of wastes.

- Promote good personal hygiene practices among employees.
- Maintain a clean and organized workplace.

- Implement proper waste disposal procedures to minimize environmental impact.

PC9. Briefing subordinates on health, sanitation & cleanliness.

- Educate subordinates on the importance of maintaining good hygiene and a clean work environment.
- Provide instructions on proper waste disposal procedures.
- Encourage employees to report any safety or health concerns.

PC10. Maintain healthy, easy, helping, and stress-free working environment among co-workers & subordinates.

- Foster a positive and supportive work environment.
- Address any workplace conflicts or issues promptly and effectively.
- Promote teamwork and collaboration among colleagues.

7.6.5. Environment & disposal of waste

PC11. Taking measures & methods to minimize waste of materials.

- Implement measures to minimize waste generation, such as:
    - Proper material handling and storage.
    - Efficient use of resources.
    - Recycling and reuse of materials whenever possible.

PC12. Carrying waste & left-over materials as per protocol & in earmarked area for re-use & disposal.

- Ensure that all waste materials are disposed of properly and safely.
- Segregate waste materials for recycling and disposal.
- Utilize designated areas for waste disposal.

PC13. Minimum use of non-disposable plastic material and proper disposal.

- Minimize the use of single-use plastics.
- Promote the use of reusable and biodegradable alternatives.
- Ensure the proper disposal of any plastic waste.

7.6.6. Assessment Criteria:

The assessment for NOS 06 is divided into theoretical and practical components, ensuring that learners are evaluated on both their knowledge and their ability to apply that knowledge in real-world scenarios:

- **Theory (50 Marks):**

Provides a strong understanding of safety regulations, hazard identification, emergency procedures, health and hygiene practices, and environmental protection principles.

- **Practical (50 Marks):**

Develops Practical Skills by allowing trainees to identify and assess workplace hazards, recognize potential safety and health risks, implement safety measures through demonstrating the proper use of PPE and emergency procedures.

7.7. NOS 7: Employability Skills (DGT/VSQ/N0102)

7.7.1. Overview:

The National Occupational Standard (NOS 8): Employability Skills (DGT/VSQ/N0102) is designed to equip learners with a broad range of essential skills that are critical for success in any professional environment. This NOS covers key areas such as communication, financial literacy, digital skills, and teamwork, ensuring that individuals are well-prepared to navigate the demands of the modern workplace and advance their careers.

7.7.2. Scope:

The scope of SSD/N0102 includes the following key components:

This scope statement outlines a comprehensive program aimed at developing essential employability skills. Let's break it down:

- **Introduction to Employability Skills:**
    - This likely sets the stage by defining what employability skills are and why they are crucial for success in the modern workplace.
    - It may cover topics like work ethic, professionalism, teamwork, and time management.
- **Constitutional Values - Citizenship:**
    - This module focuses on understanding and appreciating the values enshrined in the constitution of the relevant country.
    - It may cover topics like fundamental rights, duties of citizens, and the importance of civic engagement.
- **Becoming a Professional in the 21st Century:**
    - This module explores the evolving nature of work in the 21st century.

- It may cover topics like technological advancements, globalization, and the importance of lifelong learning and adaptability.

- **Basic English Skills:**
  - This module focuses on developing essential English language skills, including:
    - Reading and writing skills
    - Communication and presentation skills
    - Listening and comprehension skills
    - Vocabulary and grammar

- **Career Development & Goal Setting:**
  - This module helps individuals understand their career goals, identify potential career paths, and develop strategies for achieving their career aspirations.
  - It may involve career assessments, resume and cover letter writing, and interview preparation.

- **Communication Skills:**
  - This module goes beyond basic English skills to focus on effective communication in a professional setting.
  - It may cover topics like:
    - Active listening
    - Non-verbal communication
    - Interpersonal communication
    - Written communication (emails, reports)
    - Presentation skills
    - Negotiation and conflict resolution

- **Diversity & Inclusion:**

- This module promotes an understanding and appreciation of diversity in the workplace.
- It may cover topics such as:
  - Cultural diversity
  - Gender diversity
  - Age diversity
  - Disability inclusion
  - Creating an inclusive and respectful work environment

- **Financial and Legal Literacy:**
  - This module covers essential financial and legal concepts, such as:
    - Financial planning and budgeting
    - Understanding contracts and legal agreements
    - Consumer rights and responsibilities
    - Financial literacy and money management
- **Essential Digital Skills:**
  - This module focuses on the development of essential digital skills, such as:
    - Computer literacy
    - Internet safety and security
    - Digital communication and collaboration tools
    - Information and data literacy
    - Basic computer programming or coding skills (if applicable)
- **Entrepreneurship:**

- This module explores the concepts of entrepreneurship and starting a business.
- It may cover topics like:
  - Identifying business opportunities
  - Developing a business plan
  - Marketing and sales
  - Accessing funding

- **Customer Service:**
  - This module focuses on developing excellent customer service skills, such as:
    - Effective communication with customers
    - Understanding customer needs
    - Resolving customer issues and complaints
    - Providing excellent customer service experiences
- **Getting ready for Apprenticeship & Jobs:**
  - This module prepares individuals for the job search process, including:
    - Resume and cover letter writing
    - Job search strategies
    - Interview preparation and techniques
    - Job application procedures
    - Workplace etiquette and professionalism

Learning Objectives: The learning objectives of NOS 7 are focused on providing a comprehensive set of skills that are applicable across various professional environments. The key learning objectives include:
Communication Skills:

Develop strong verbal and written communication skills that are essential for effective interaction in diverse settings, including formal and informal workplace communication.

Financial Literacy:

Learn to manage personal finances effectively, understand the components of a salary slip, and conduct safe online financial transactions. This includes budgeting, saving, and making informed financial decisions.

Digital Skills:

Gain proficiency in using digital devices such as computers and smartphones, software applications like word processors and spreadsheets, and online platforms for communication and collaboration. Understand the importance of online safety and data protection.

Career Development:

Understand the difference between a job and a career, and learn how to set and achieve career goals. This includes the development of a professional résumé, preparing for job interviews, and engaging in continuous learning and skill development.

Performance Criteria: To effectively meet the standards of NOS 7, learners are expected to demonstrate competency in the following areas:

7.7.3. Introduction to Employability Skills

PC1. Identify employability skills required for jobs in various industries

- This involves recognizing the core skills and attributes that are valued by employers across different sectors.
- These skills may include:
    - Communication skills (written and verbal)
    - Teamwork and collaboration
    - Problem-solving and critical thinking
    - Time management and organization
    - Adaptability and flexibility
    - Technological skills
    - Work ethic and professionalism
    - Customer service skills

The ability to identify the specific employability skills required for different job roles and industries is crucial.

PC2. identify and explore learning and employability portals

- This involves researching and exploring online resources and platforms that provide information and support related to career development and job searching.
- This may include:
    - Job boards and career portals (e.g., Indeed, LinkedIn)
    - Government employment services
    - Educational and training institutions
    - Online learning platforms (e.g., Coursera, edX)
    - Professional networking sites

7.7.4. Constitutional Values – Citizenship

PC3. recognize the significance of constitutional values, including civic rights and duties, citizenship, responsibility towards society

etc. and personal values and ethics such as honesty, integrity, caring and respecting others, etc.

- Understand the fundamental rights and responsibilities of citizens as outlined in the constitution.
- Appreciate the importance of civic engagement and participation in society.
- Recognize and uphold personal values and ethics such as honesty, integrity, respect, and responsibility.
- Understand the importance of social responsibility and contributing positively to society.

7.7.5. Becoming a Professional in the 21st Century

PC4. recognize the significance of 21st Century Skills for employment

- Understand the importance of 21st-century skills in the modern workplace, such as:
- Creativity and innovation: Ability to think outside the box and generate new ideas.
- Critical thinking and problem-solving: Ability to analyze information, evaluate evidence, and solve complex problems.
- Communication and collaboration: Ability to effectively communicate and collaborate with others.
- Technology skills: Proficiency in using technology tools and digital platforms.
- Lifelong learning: The ability to continuously learn and adapt to new challenges and technologies.

PC5. Practice the 21st Century Skills such as Self-Awareness, Behaviour Skills, time management, critical and adaptive thinking, problem-solving, creative thinking, social and cultural awareness, emotional awareness, learning to learn for continuous learning etc. in personal and professional life

- Develop and demonstrate these 21st-century skills in personal and professional contexts.
- Practice self-awareness and emotional intelligence.

- Develop effective time management and organizational skills.
- Cultivate critical thinking and problem-solving abilities.
- Demonstrate adaptability and flexibility in various situations.
- Engage in continuous learning and professional development.

7.7.6. Assessment Criteria:

The assessment for NOS 8 is divided into theoretical and practical components, ensuring that learners are evaluated on both their understanding of employability concepts and their ability to apply these skills in real-life scenarios:

- **Theory (20Marks):**

Assesses the learner's understanding of key concepts such as financial literacy, digital skills, and career development. This includes knowledge of financial products, legal rights, and communication principles.

- **Practical (30 Marks):**

Evaluates the learner's ability to apply employability skills in practical scenarios, such as preparing a professional résumé, conducting a mock job interview, and using digital tools for workplace tasks.

Employability Skills (DGT/VSQ/N0102) provides a comprehensive foundation for developing the essential skills needed to thrive in any professional environment. By focusing on communication, financial literacy, digital proficiency, and career development, this NOS ensures that learners are well-prepared to meet the demands of the modern workplace, advance their careers, and achieve long-term professional success. Adhering to this standard not only enhances individual employability but also contributes to a more skilled and capable workforce.

8. Chapter 1: Introduction of Scaffolding

Scaffolding is a **temporary** means of support used by most trades in the building and other Construction industry and for maintenance and services jobs in operating plants as:

- A means of access.
- A platform to work from and/or to store or support materials; and
- A way to provide protection to persons below.

Scaffolding Accident Statistical Analysis

Some 4,500 workers are injured every year in scaffolding falls. About 50 of those injuries result in death. One out of every 10 work-related deaths is caused by a fall.

Scaffolds and ladders are involved in approximately 40 percent of injuries caused by falling. Falls are the most common cause of construction-related deaths in the construction industries.

If correct safety precautions are followed, the majority of falls can be prevented. Usually, the following types of injuries occur;

- Injuries from Falling with Failed Scaffold
- Injuries from Falling off of Scaffolding
- Injuries from Dropped Items
- Pinch and Crush Injuries

8.1. Definitions and Terminologies

Scaffolding

- Means any basic scaffolding, basic scaffolding, or suspended scaffolding or structure, of a temporary nature, used or intended to be used —
- For the support or protection of persons carrying out construction work or work connected with construction work, for the purpose of carrying out that work;
- For the support of materials used in connection with any such work;
- Includes any scaffolding constructed as such and not dismantled, whether or not it is being used as scaffolding; and
- Includes any coupling, device, fastening, fitting or plank used in connection with the construction, erection, or use of scaffolding.

Lift

The assembly of ledgers and transoms forming each horizontal level of a scaffold.

Lift Height

The lift height is the vertical distance between two lifts, measured center to center.

Live load

That portion of a load which does not include any part of the scaffolding or decking supporting the load, and comprises the weight of workers and/or materials.

Dead load

That portion of a load which includes the weight of all parts of the scaffolding except persons and environmental load.

Safe working load (SWL)

The maximum load calculated in accordance with sound and accepted engineering practices, which can be supported safely under normal working conditions.

Bay

Space between the center lines of two adjacent standards along the

face of a scaffold.

Foot lift

Lift erected nearest to the ground.

Free-standing scaffold

A scaffold which is not attached to any other structure and is stable against overturning on its own account, or if necessary, assisted by guys or rakers and anchors.

Independent tied scaffold

A scaffold which has two lines of standards, one line supporting the outside of the deck and one to the inside. The transoms are not built into the wall at the structure. It is not free standing, but is tied into the structure to prevent overturning.

Slung Scaffold

A scaffold hanging on tubes, ropes or chains from a structure overhead. It is not capable of being moved or lowered.

Suspended scaffold

A scaffold hanging on ropes which is capable of being suspended, or raised and lowered.

Tubular Members and Beams:

Brace

A tube placed diagonally with respect to the vertical or horizontal members of a scaffold and fixed to them to afford structural strength.

Bridle

A horizontal tube fixed across an opening or parallel to the face of a structure to support the inner end of a putlog, transom or tie tube.

Bolted tie

Assembly of nuts, bolts, anchors, rings or tubes fixed into the surface of a structure.

Butting transom

Transom extended inwards to butt the structure to prevent scaffolding moving inwards.

Face brace

A brace parallel to the face of a structure.

Guard-rail

A member incorporated in a structure to prevent the fall of a person from a platform or access way.

Knee brace

A brace across the corner of an opening in a scaffold to stiffen the angles or to stiffen the end support of a beam.

Ledger

A longitudinal tube normally fixed parallel to the face of a structure in the direction of the larger dimensions of scaffold. It acts as a support for the put logs and transoms and frequently for the tie tubes and ledger braces and is usually joined to the adjacent standards.

Ledger brace

A brace at right angles to a structure.

Longitudinal brace

A brace generally in the plane of the longer dimension of the scaffold, particularly in 'bird-cages'.

Movable tie

A tie which may be temporarily moved for the execution of work.

Non-movable tie

A tie which will not be moved during the life of a scaffold, as agreed between the user and the scaffold erector.

Plan brace

A brace in a horizontal plane.

Prop tie

An assembly of telescopic props and/or scaffold tubes jacked or wedged between the floors inside a structure and including a tie tube.

Standard

A vertical or near vertical tube which carries scaffold's weight, and loads imposed to the supporting structure.

Sway transom

A transom extended inwards in contact with a reveal or the side of a column to prevent the scaffold moving sideways.

Through tie

A tie assembly through a window or other opening in a wall.

Tie or tie assembly

The components attached to an anchorage, or the structure, or framed around a part of it, or wedged or screwed into it with a tie tube. Used to secure the scaffold to the structure.

Transom

A tube spanning across ledger to form the support for boards or units forming the working platform, or to connect the outer standard to the inner standard.

Transverse brace

A brace generally in the plane of the shorter dimension of the scaffold.

Scaffold Couplers and Fittings:

Adjustable base plate

A metal base plate embodying a Screw Jack.

Base plate

A metal plate with a spigot for distributing the load from a standard or raker or other load-bearing tube.

Brace coupler

This coupler, whilst primarily designed for securing put logs and transoms to ledgers, also conforms to the requirements for a bracing coupler.

Coupler

A component used to fix scaffold tubes together.

Joint pin

An expanding fitting placed in the bore of a tube to connect one tube to another coaxially.

Parallel coupler

A coupler used to join two tubes in parallel.

Right-angle coupler

A load-bearing coupler used to join tubes at right angles.

Sleeve coupler

An external coupler used to join one tube to another coaxially.

Sole plate

A timber, concrete or metal spreader used to distribute the load from a standard or base plate to the ground.

Swivel coupler

A coupler used for joining tubes at an angle other than a right angle.

Toe board

Up stand at the edge of a platform, intended to prevent materials or operatives' feet from slipping off the platform.

8.2. Roles and responsibilities

The following is a broad set of responsibilities for the key positions for scaffolding / access environment. It is recommended that they shall be used as the basis for the development of local rules that more specifically define the key interfaces and responsibilities in conjunction to other company HSE procedures. These guidelines shall not be considered as standalone and shall require to be in line with other relevant and existing procedure like Permit To Work, Job Safety Analysis, six directional hazards identification etc.

Only project approved or certified competent personals shall be assigned to oversee the scaffold selection, erection, use, movement, alteration, dismantling, maintenance and inspection. Only assigned, trained and experienced personnel shall be allowed to work on scaffolding.

It shall be insured that competent personnel have complete knowledge about the type of scaffolding to be used and about the proper selection, care and use of fall protection equipment (perimeter protection, fall protection/work positioning, full harnesses, lanyards, lifelines, rope grabs, shock absorbers, and any other equipment that has to be used).

8.2.1. Scaffold Work Supervisors

If a certain task requires erection of scaffold, it shall be responsibility of the scaffold Work Supervisor In charge of that work to request the Scaffold in order to complete a scope of work or service. The Work Supervisor therefore has a number of responsibilities to fulfill to assist in the safe and efficient erection of any access structure:

- Formally notify the Scaffolding Foreman of access requirement.
- Accurately define the scope of the access requirements, to assist the scaffolding contractor in ensuring that the structure is 'fit for purpose' on erection.
- Ensure that reasonable timescales are provided to allow sufficient pre task planning and risk assessment to be carried out by the Scaffolding Foreman.

8.2.2. Scaffolding Foreman

The Scaffolding Foreman will be the central focus for all access activities. This ensures that one central point is utilized to co-ordinate all aspects of access management, reducing risk and increasing efficiency. The following responsibilities ensue:

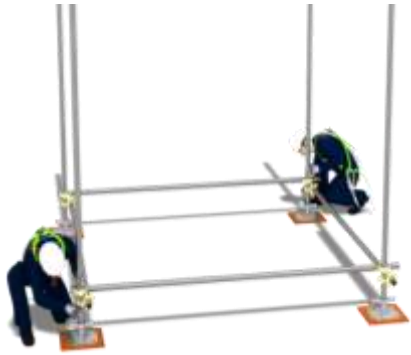
- Arrange appropriate Permit to Work compliance at all times. Co-ordinate the completion of Job Hazard Analysis and toolbox talks to relay information and instructions to the working party.
- Ensure that any potential conflicts of activities are addressed during the pre-job planning.
- Request Design Engineer assistance if access requirements are not within the parameters of standard.

- Ensure that sufficient materials are readily available to complete work scopes.
- Allocate personnel to the task ensuring competencies and numbers are sufficient to complete tasks safely.
- Handover completed scaffold structure to work supervisor / end user. Ensure that a competent person is available to conduct statutory 7-day inspections and to maintain the inspection tags and scaffold.

- Make adequate provisions available (labour) for the safe dismantle of access structures.
- Follow all the company safety rules and local rules relating to 'adverse weather' policy.

8.2.3. Scaffolder

- All persons who erect scaffolds shall be trained in the safe erection, dismantling and alteration of the scaffolding.
- A Job Hazard Analysis (JHA) is carried out prior to a scaffold being built.
- The erected scaffold complies with the relevant standards and guidelines.
- Supervisor shall ensure that no un-insulated electric wire exists within three meters of the working platform, gangways and any part of the scaffold.
- Incomplete or damaged scaffolds are identified by signs and their use is prohibited pending rectification.



- Edge protection is provided to the open sides and ends of any platform where a risk assessment highlights a danger of people falling or at any height above 1.8 metres.
- Protective measures are taken to separate other personnel and the public from the dangers of scaffolding while erecting, altering or dismantling scaffolding, particularly on, over or adjacent to any public thoroughfare or adjoining property.
- Scaffolds are inspected for fitness of purpose by a competent person before the first use, and at intervals not exceeding 30 days, as soon as practicable and prior to further use following an occurrence that could have affected the stability or

adequacy of the scaffold and prior to its use following repairs, alterations, or modifications.

8.2.4. Scaffold / Access platform user

To ensure that the scaffolding / access platform is maintained to as safe a standard as practical, the user has these key responsibilities:

- All The users should ensure that they have undergone adequate training to use the scaffold correctly prior to using a scaffold.
- They know all emergency procedures relating to the scaffold.
- They understand the loading limitations and restrictions relating to the scaffold and the need to keep within them.
- Prior to a scaffold being used they make sure there is positive indication that the scaffold is ready for use. The scaffold should not have any tag, notice or sign that advises that the scaffold should not be used or should be limited in its use.
- Conduct a Job Hazard Analysis (JHA) for the activities to be carried out on the scaffolding structure.
- There is effective lighting of all approaches, access ways, walkways, working platforms and exits before using a scaffold.
- Identify and manage any conflicting activities that occur when using the scaffolding / access structure.
- Ensure that the scaffold is 'fit for purpose' for the intended work scope. Any alterations to the structure should be requested to the scaffolding foreman.
- Notify the scaffolding foreman of any changes to the scaffold due to weather, damage or collision.
- Maintain a high level of housekeeping / tidiness whilst working on the access platform and when leaving the worksite unattended.
- Formally notify the scaffold foreman when work on scaffold has ceased, ensuring the access platform is left in an acceptable condition.

8.2.5. Scaffold Inspector

The roles and responsibilities of a Scaffold Inspector are critical for ensuring worker safety on construction sites.

- **Conducting Thorough Inspections:**
    - Performing regular and comprehensive inspections of all scaffolding structures, including those under construction, in use, and during dismantling.
    - Identifying and assessing potential hazards such as overloading, instability, inadequate bracing, and missing or damaged components.
    - Evaluating the overall structural integrity of the scaffold, ensuring it can safely support the intended loads.
- **Ensuring Compliance:**
    - Verifying compliance with all relevant safety regulations, standards, and best practices, including those from OSHA, ANSI, and local jurisdictions.
    - Ensuring that the scaffold is erected and used in accordance with approved design plans and specifications.
- **Fall Protection Assessment:**
    - Assessing the effectiveness of fall protection systems, such as guardrails, mid rails, toeboards, and personal fall arrest systems (PFAS).
    - Identifying and addressing any deficiencies in fall protection measures.
- **Documentation and Reporting:**

- Preparing detailed inspection reports, including observations, photographs, and recommendations for corrective actions.
- Maintaining accurate records of all inspections and any necessary repairs or modifications.
- Communicating inspection findings and recommendations to site supervisors, project managers, and other relevant personnel.

- **Promoting Safety:**
  - Providing guidance and training to scaffold erectors and other workers on safe scaffolding practices.
  - Advocating for a strong safety culture on site, emphasizing the importance of safe scaffolding practices among all workers.
  - Investigating any accidents or incidents involving scaffolds, identifying root causes, and recommending corrective actions to prevent future occurrences.

- **Staying Updated:**
  - Continuously updating knowledge and skills on the latest advancements in scaffolding technology, safety regulations, and industry best practices.

8.3. Types of Scaffolding

Scaffolding is a temporary structure used to support people and materials in the construction or repair of buildings and other large installations. Commonly being highly-raised means for work, safety becomes the main factor to care about.

Building of the scaffolding systems presents challenge of creation, which are versatile, safe, long-lasting and fast to assemble. One has to find the balance between the price and the quality. The most popular types of scaffolding system being used in the majority of industries are as follows:

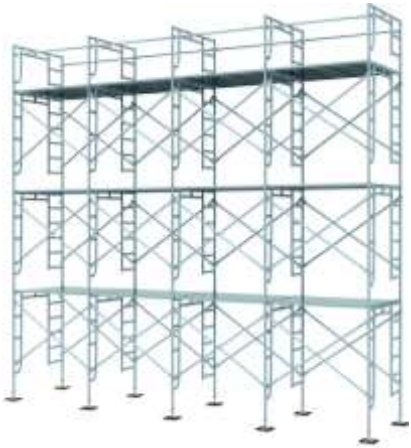
Most popular types of Scaffolding System

Tubes & Fitting

Cup lock System

Ring lock Methods

H-Frame Wedge Lock system



Scaffolding equipment

Mast Climbers

Cantilevered Materials Hoists

Articulated Boom Elevated platform Scissor Elevated Work Platform

Depending on its use and design, scaffolding may be standing, freestanding, Cantilever, hanging, suspended, mobile or special.

Dependent Scaffold

Pole scaffold- with only one row of standards and other side supported on wall or any structure.

Independent Scaffold

Tower Scaffold

Mobile Scaffold

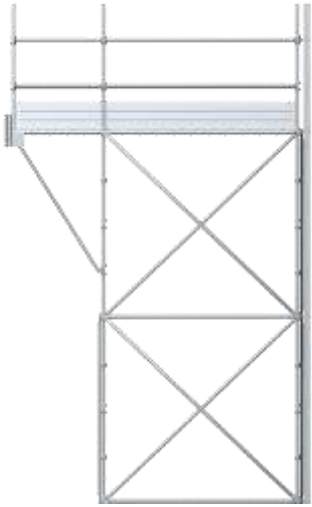
Hung Scaffold

Birdcage Scaffold

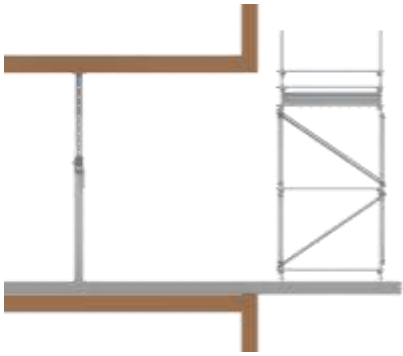
Suspended Scaffold

Spur or Extended Scaffold

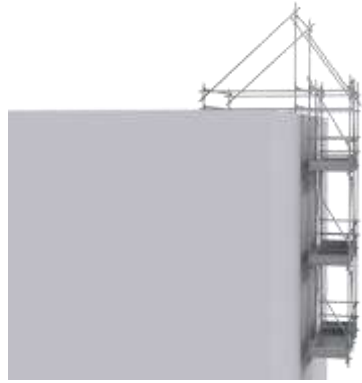
Cantilever Scaffold



Beam Cantilever Scaffolds



Drop Scaffolds



Sloping Platform Scaffolds

8.4. Scaffolding Components

8.4.1. Tube & Coupler Type Scaffolding

Tube & Fitting Components

Wooden Sole Board: used below the horizontal Base plate to transfer load to the ground.

Base Plate: Horizontally placed base on ground or Sole plate on which standards are vertically erected.

Standard: Main vertical pipe to hold all loads & finally transfer to ground.

Right Angle Clamp: To join two pipes at 90^0, one vertical and other horizontal.

Swivel Clamp: To join 2 pipes at any angle other than 90^0

Plank Fixing Clamp: Clamp that fixes plank with transom.

Hook on Steel Plank: To securely place the plank on transom.

Adjustable Toe Guard: Toe guard that can be attached at any location along the corner of the platform.

Sleeve Coupler: Coupler with fixing arrangement for joining two horizontal pipes from outside.

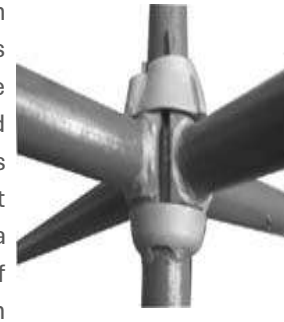
Ladder: Meant for gaining access to higher locations.

Ladder Clamp: A clamp used to firmly bind ladder to the scaffold leg.

Joint Pin: Pin is introduced to the joint to hold in position and not allow to get separated.

Beam Clamp: Pair of clamps placed and tightened over the flange on its either side holds the hanging pipe firmly in position.

8.4.2. Cuplock/ Ring lock /System Scaffolding



Cuplock is a unique node point connection which allows up to four horizontal members to be connected to a vertical member in one single action - without the use of nuts and bolts or wedges. The locking device is formed by two cups. Single node point action of unique locking makes Cuplock a fast, versatile and optimized system of scaffolding for construction, demolition and maintenance projects throughout the globe.

Various Cuplock Systems components manufactured by Scaffolding manufacturer are as follow

Standard / Vertical Cuplock:

Size	Weight
3.0	17.69
2.5	14.86
2.3	13.33
2.0	12.02
1.8	10.50
1.5	9.19
1.3	7.66
1.0	6.35

Cuplock spigotted standards are manufactured from 48.3mm O.D. tube. They have **cup joints** at 500mm intervals. The captive mobile top cups are designed to endure rough site handling and welded bottom cups are made from high-quality steel. Integral spigots are provided at the top of each **standard for making vertical connections**. The **spigots** and the base of each standard incorporate 11/16mm dia. holes to enable use of locking pins to join **standards** where necessary.

Ledger / Horizontal Cuplock

Size	Weight
2.5	9.17
2.0	9.39
1.8	6.68
1.5	5.61
1.3	4.90
1.2	4.72
1.0	3.83
0.9	3.47
0.6	2.40

The **Ledgers** are manufactured from 48.3mm O.D. tube with forged steel blade ends which locate into bottom **cups** of the standards and are locked in place by the corresponding top **cups. Ledgers** are available in various lengths to provide the desired grid dimension for **scaffolding or formwork**.

Cuplock Transom

Transoms are fabricated from twin structural angles fixed back to back with a drop forged blade attached to each end. The 1.8m and above Transom has an additional web member welded below the flange section for added strength. The transom blade locates into a

bottom cup and is locked in position by the top cup. The outward standing bottom leg of the angles supports the steel planks in a captive manner. Available in various lengths to suit scaffolding and formwork applications

Cuplock Intermediate Transom

For use where distance between standards exceeds the span of scaffold boards Cuplock intermediate transoms Available in various lengths.

Cuplock Return Transom

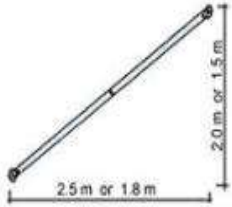
The Return Transom is used at the end of a scaffold run where it meets another scaffold running at right angles to it. The U-shaped return section of the transom hooks over the ledger of the adjacent scaffold, closing off the gap between the two scaffold.

Ladder Access Transom

The Ladder Access Transom is used to provide an opening in a bay allowing a ladder to pass through it. The L.A. Transom is attached to and spans between the ledgers in the bay.

Cuplock Bracing

For diagonal bracing of scaffolding a range of longitudinal braces made with swivel forged blades at either ends to be fitted into cups of Cuplock standards are available.



Cuplock Cantilever Frame

This item is used for providing support to decking or formwork at edges. This frame has ledger blades to be fitted into cups of Cuplock standards at one end and with provision for accepting jacks in three positions at the other end at 1.2 m, 1.25 m and 1.3 m from centreline of the standard.

Beam Brackets

It is fixed on the main vertical supporting beams and can avoid separate vertical for supports of slab form work.

Hop-Up 1/2/3 Bracket

Hop-up Brackets are designed in omega sections as well as in tubes sections for placing battens with provision of forged blades to be fitted with Cuplock standards by cup joint. Omega Hop-up brackets are available for single board, two board and 3 board allocations.

Cuplock Bridging Horizontals

Scaffolding bridging item are used to provide working platform complete with necessary guardrails for vehicle passage.

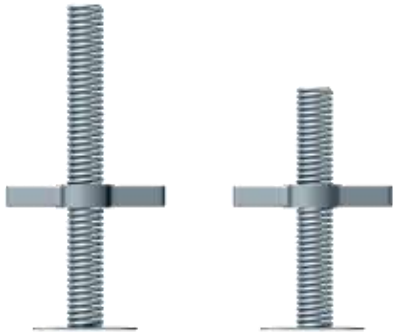
Loose Spigot

Made out of 300 mm long square which are used for connecting verticals with or without belt.

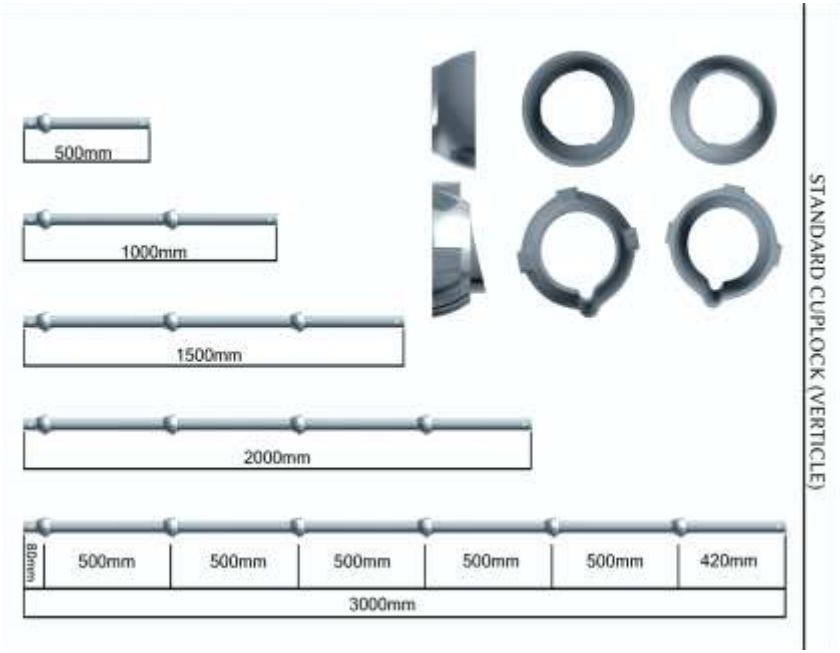
Adaptor

The Drophead Adaptor units provide for the easy conversion of Dropheads from the Waffle and Trough or Metri-form Support Systems for use with Cuplock.

Adjustable Screw base Jack: Screw jack fixed on base plate to adjust the height of standards as per need.



Standard: Main vertical pipe to hold all loads & finally transfer to ground.



Ledger: Horizontal member placed between two cup locks on adjacent standards.

Hooks on Steel Plank: To securely place the plank on transom.

Diagonal Brace: Diagonally placed brace in vertical plane to provide rigidity to scaffold.

Ladder: Meant for gaining access to higher locations.

Ladder Clamp: A clamp used to firmly bind ladder to the scaffold leg.

Adjustable Toe Guard: Toe guard that can be attached at any location along the corner of the platform.

Cuplock Cantilever Frame: A frame attached to two up down cuplocks and projecting outward in cantilever fashion to be used for holding planks or other attachments.

Cuplock drophead bracing adaptor: An adaptor attached to the cuplock to hold and provide support to brace dropping below.

Clamp with Ledger Blade: The two blades on opposite sides shall be fixed in cuplock and on the side any attachment e.g. pipe may be fixed.

Cuplock side brackets: An extending bracket deriving support from the standard after its top end getting fixed in the cup lock which can be used for any purpose.

Intermediate Transom: Is used for providing additional support to the planks of the platform.

Plank Fixing Clamp: A clamp having extension to accommodate planks of the platform.

Putlog Clamp: Clamp fixed on the ledger to provide support to bearer (Putlog) pipe.

Spigot: Internally placed co-axial pipe to join two vertical standard pipes for extension.

Toe Guard Clamp: Clamp meant for holding toe guards.

Toe Guard: Guard attached on the corner of the platform to prevent anything from falling.

Cuplock Forkhead: Forkhead attached at the top end of the standard to hold wooden blocks in form work and other applications.

Cuplock inside Board transom: Placed inside over ledges with locking arrangement to provide intermediate support to hold one or two inside boards.

8.5. Basic Principle of Scaffolding Design

A basic principle of scaffolding design shall be based on;

- The strength, stability and rigidity of the supporting structure;
- The handling normally associated with scaffolding;
- The safety of persons engaged in the erection, alteration and dismantling of the scaffold;
- The safety of persons using the scaffold;

8.5.1. Basic scaffolding Design considerations

Before the erection of any scaffold the following points must be clearly defined:

- **What is the scaffold for?**
  - Determine the specific purpose of the scaffold.
  - Is it for bricklaying, painting, window cleaning, or other tasks?
  - This will influence the height, size, and configuration of the scaffold.
- **Exactly where is it to be erected?**
  - Pinpoint the exact location of the scaffold on the site.
  - Consider proximity to buildings, overhead power lines, and other obstructions.
  - Assess the ground conditions (level, stability, soil type) at the erection site.
- **What materials are to be used?**
  - Select appropriate scaffolding materials based on the project requirements and load capacity.
  - Ensure that the materials are in good condition and meet safety standards.
- **Can safe access be provided for the erection and use of the scaffold?**

    - Plan safe access and egress routes for workers, including ladders, stairways, and platforms.
    - Ensure that there is sufficient space for the safe movement of workers and materials around the scaffold.
- **How many working platforms will there be?**
    - Determine the number of working platforms required based on the work to be performed.
    - Consider the height of the work area and the number of workers required.
- **What loadings will be imposed upon those working platforms, and on the scaffold as a whole?**
    - Estimate the anticipated loads on the scaffold, including the weight of workers, materials, tools, and equipment.
    - Consider potential impact loads and environmental loads (wind, snow, etc.).
- **Is the ground condition where the scaffold is to be erected suitable?**
    - Assess the ground conditions to ensure that the scaffold can be safely erected and supported.
    - Consider factors such as soil stability, ground level, and potential for ground movement.
- **How and where can the scaffold be tied in?**
    - Determine how the scaffold will be tied or anchored to the building or other structures to ensure stability.
    - Select appropriate tie-in points and ensure that the ties are installed correctly and securely.
- **What bracing will be required?**
    - Determine the type and amount of bracing required to ensure the stability of the scaffold.
    - Consider factors such as scaffold height, wind loads, and the proximity of the scaffold to other structures.

8.5.2. Different Types of Loads

Following three main types of loading need to be considered for Design:

Permanent loads; (Dead Load)

It includes the self-weight of the scaffold structure, including all components, such as platforms, fences, fans and other protective structures and any ancillary structures such as hoist towers.

- These are the constant, unchanging loads that the scaffold itself must support.
- This includes the weight of the scaffold itself (standards, ledgers, transoms, platforms), any attached equipment (hoists, fans), and any permanent fixtures on the scaffold.

Variable loads; (Live Load)

It includes service loads (loading on the working area, loads on the side protection)

- **Service Loads:** The weight of workers, tools, materials, and any equipment used on the working platforms.
- **Side Protection Loads:** The weight of guardrails, midrails, and toeboards.

Accidental loads; (Environmental Load)

- **Wind Load:** The force exerted by wind on the scaffold, which can significantly impact its stability.
- **Snow and Ice Loads:** Applicable in regions with significant snowfall or icing, adding weight to the scaffold structure.

Design Loading

- The design load is the maximum weight that a scaffold or structure can safety support.
- The design loads are as per using load tables in accordance with appropriate limits, standards and specifications.

- Scaffolds have different design loadings and minimum platform sizes according to their load bearing capabilities:

Scaffold Classes/Duties and Dimensions

Loads and Dimensions for Tube and Fittings Scaffold

Type of Scaffold	Use of Scaffold	Scaffold loading per m2	Maximum number of working platforms	Maximum spacing between Standards	Typical load examples per bay
Very light duty independent	Inspection access and painting	75 kg	1 working platform	2.7 m	1 man and tools. No materials
Light duty independent	Power cleaning, painting, light engineering	150 kg	2 working platforms	2.4 m	2 men and tools. No materials
General purpose independent	Light engineering, e.g. welding or electrical	200 kg	2 working platforms and 1 at very light duty	2.1 m	2 men and 175 kg of materials
Heavy duty independent	Heavy engineering, e.g. large pipework or structural	250 kg	2 working platforms and 1 at very light duty	2.0 m	2 men and 250 kg of materials
Special purpose	To be stated on design drawings				

8.5.3. Calculation of design load for the scaffold

This focuses on the critical aspect of determining the maximum safe load that the scaffold can withstand. The following are to be considered.

- **Material Strengths:**
    - **Material Selection:** The choice of materials significantly impacts the scaffold's load-bearing capacity. Common materials include steel, aluminium, and wood.
    - **Material Properties:** Determine the yield strength, tensile strength, and other relevant material properties of the chosen materials. This information is crucial for calculating the safe working loads.
    - **Corrosion Resistance:** Consider the material's resistance to corrosion, especially in environments with high humidity or exposure to corrosive chemicals.
- **Structural Analysis:**

  Analyze the scaffold's structural integrity: This involves a thorough evaluation of the scaffold's design and construction to ensure it can withstand the anticipated loads without failure.
    - **Spacing of standards and ledgers:** The spacing of vertical (standards) and horizontal (ledgers) members directly impacts the scaffold's strength and stability.
    - **Bracing configurations:** The type, number, and arrangement of braces (diagonal members) significantly influence the scaffold's resistance to lateral loads (e.g., wind).
    - **Connections between components:** The strength and reliability of the connections between different

components (standards, ledgers, couplers) are crucial for overall structural integrity.

- **Ground conditions (if stable):** The stability of the ground beneath the scaffold is critical. Uneven or unstable ground can compromise the scaffold's stability and increase the risk of collapse.

- **Calculate Safe Working Loads:**
  - **Determine the maximum loads:** Based on the material strengths, structural analysis, and anticipated loads (dead, live, and accidental), calculate the maximum safe working loads for the scaffold.
  - **Safety Factors:** Apply appropriate safety factors to account for uncertainties and potential variations in loads. Safety factors typically range from 1.5 to 4, depending on the specific application and relevant standards.
  - **Engineering Calculations:** This may involve complex engineering calculations and may require the assistance of qualified professionals, such as structural engineers, to ensure accurate and reliable design

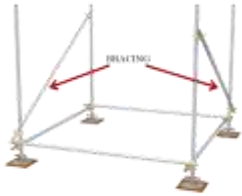
8.5.4. Bracing and Ties

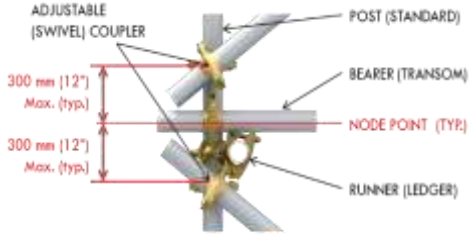
All scaffolds shall be braced and tied to form a rigid stable structure. There are minimum requirements for bracing and tying a scaffold, but these are a guide only to the scaffolder. A priority concern is to provide a safe working platform free from movement. If this priority is not satisfied on completion of the minimum requirements for bracing and tying, the scaffolder is bound to include such extra ties and braces as are needed.

Braces

Brace: A rigid connection of scaffold tubing that holds one scaffold member in a fixed position with respect to another member to give the scaffold rigidity.

With the exception of tower and single bay scaffolds, face braces shall be provided that are attached to the external row of standards of the scaffold as close to the junction of the ledger and standard as is practicable and extend to the full length and height of the scaffolding. Transverse heel and toe braces shall be provided that are attached diagonally in every lift joining the internal and external standards at both ends of the scaffold and at intervals not exceeding 25 metres. Tower and single bay scaffolding shall be provided with braces diagonally in every face in every lift of the scaffold.





BRACE CONNECTION

Bracing satisfies 2 conditions.

- It provides nodal restraint and resists external forces..
- The bracing take-up all the horizontal loads.

Type of Brace are :

- Longitudinal Brace
- Transverse Brace
- Plan Brace

Longitudinal (Facade or Sway) Bracing:

- Diagonal braces installed in the plane of the longer dimension (length) of the scaffold.
- Longitudinal (facade) braces shall be connected to posts (standards) as close as possible to the intersection (node point) of the runner (ledger) and post (standard).

Transverse Brace (Sectional or Ledger) Brace:

- Diagonal braces installed on shorter dimension (breadth) of the scaffold
- Transverse (sectional) braces shall be connected to either posts (standards) or runners (ledgers) as close as possible to the intersection (node point) of the bearer (transom) and post (standard).

Type Of Longitudinal/ Transverse Brace

Parallel Brace:

When bracing is established diagonally between inner and outer standards on multiple levels it forms a parallel brace.

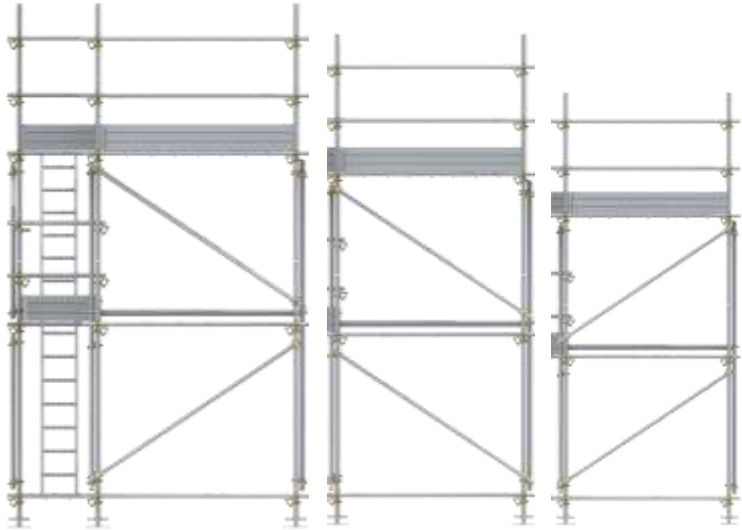
Zigzag (Dog-leg) Brace:

- Placed end-to-end and that alternate back and forth.

- When it is impractical to fit ties at vertical spacing's, dogleg bracings should be used.

Cross Brace:

- Cross-beam connecting between arches that is meant to add rigidity to the construction
- If the scaffold is erected independently or is more than 30 ft. high, it should be stiffened by cross braces running diagonally across the face of the structure and firmly lashed to all the standards.



DOGLEG BRACING **PARALLEL BRACING**

Ties

Ties shall be provided that is attached by right angle couplers to the outside and inside standards. They shall be located horizontally no further than one bay from the ends and at intervals not exceeding 4 meters.

A tie is considered a system of bracing or anchorage to an adjacent structure from a standing scaffold. Types of ties are :

- Rigid Tie
- Box Tie
- Through Tie
- Reveal /Opening Tie
- Guy Wires

Rigid Tie

A rigid tie is a scaffold tube e.g. a prop inner with a base plate, with the same dimensions and specifications as a standard base plate, fixed to the end.

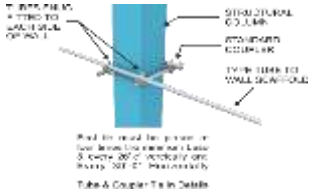
The base plate has two or four holes of 12mm to 16mm diameter drilled into the plate. Only use load-bearing couplers (double couplers) to attach ties to scaffolds.

Box Tie

Means of resisting inward and outward movement of scaffolds

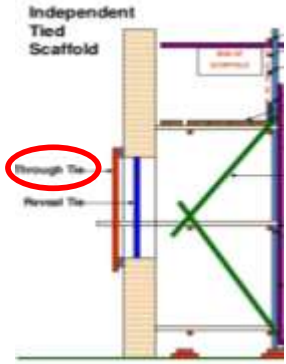
- Must be made using right angle couplers

- Strength of structure tied to must be established
- Should be considered at the design stage



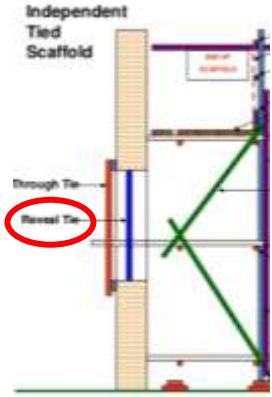
Through Tie

- Through tubes rely on a tube across the inside of a window opening.
- Through tube may be vertical or horizontal (but must have a projection of 300 mm each side of the opening).
- When using a through tie, it is essential to place a similar tube on the opposite side of the opening to prevent the scaffold moving in either direction.



Reveal Tie

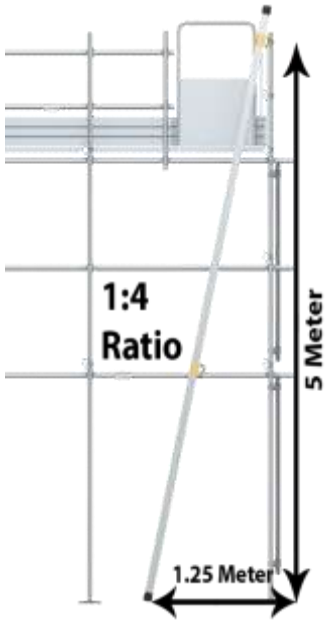
- Each reveal of a window opening acts as an anchor point for such a tie.
- This type of tie is most useful when windows remain intact.
- Ties should be evenly distributed over the scaffold, vertically and horizontally.
- The spacing of ties on a scaffold should not exceed 8.5 meters both vertically and horizontally.



8.6. Fall Prevention & Protection

8.6.1. Ladder Access

Many accidents have occurred in the past due to incorrect ladder accesses having been erected. The importance of a safe ladder access cannot be over emphasized. The practices of erecting a ladder access, as an afterthought should be discouraged so that consideration to the ladder access becomes an integral part of the job planning.



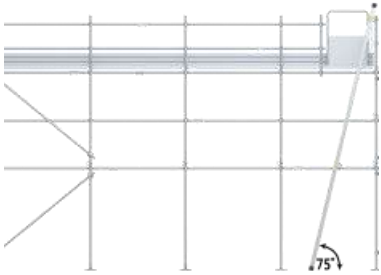
Ladders do not exceed 9 meters for single, or 15 meters for double ladders; they are also to be positioned in a 4:1 ratio, height by distance. Any ladder found to be defective shall be taken out of service immediately and removed from site to be destroyed.

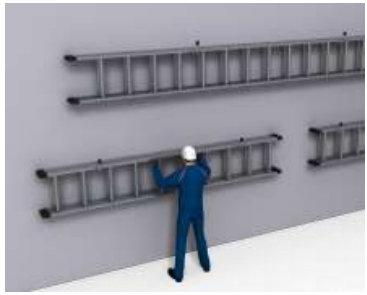
Where tubes are used to support a ladder care shall be taken to ensure such tubes do not obstruct safe footholds on the rungs.

Ladders shall be secured and shall extend not less than 1 meter above the point of access or egress.

In a ladder access tower, fully decked landing platforms shall be provided. Manholes in landing platforms shall be fitted with guardrails and a self-closing swing gate or an approved trapdoor.

It may be required in hazardous areas to have separates access and egress points, to facilitate emergency evacuation of the scaffold / area.





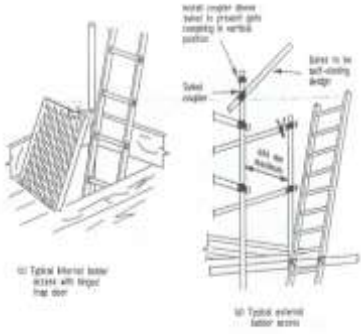


FIGURE 7.2 TYPICAL MEANS OF ACCESS

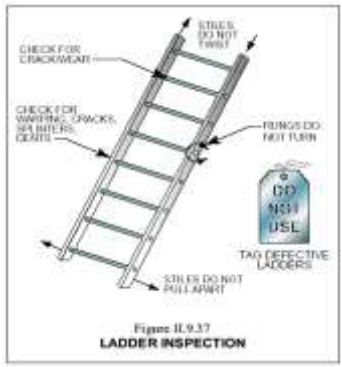
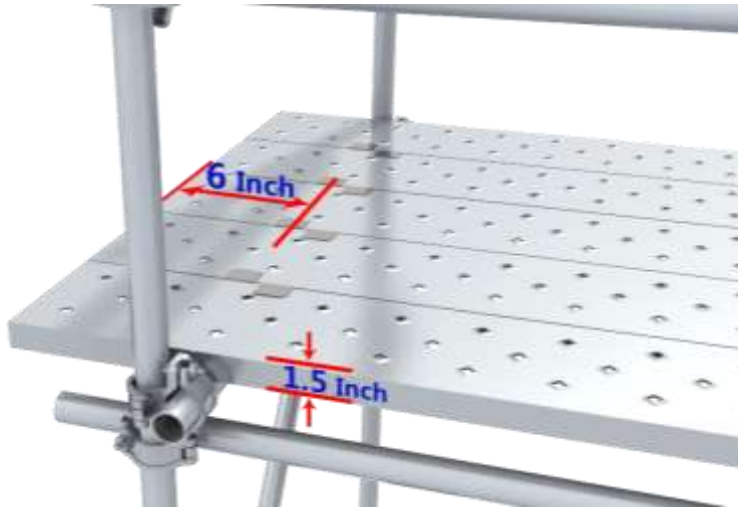


Figure II.9.37
LADDER INSPECTION

8.6.2. Working Platforms

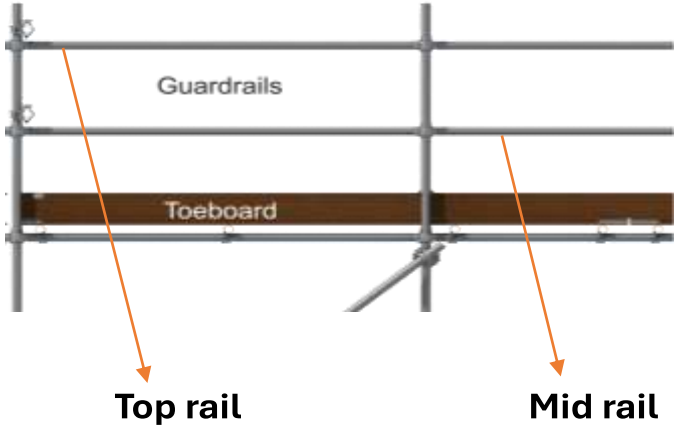
The working platform is the end result of the scaffolder endeavours and as such should be the showpiece of the job.
Hazards to personnel required to work on the working platform should be eliminated to he point that personnel feel as comfortable working aloft as working on the ground.



The following are the minimum requirements of a working platform:

- The minimum width of working platform shall be 675mm except where the platform is used for the erection of scaffolding or rigging or trestles above a height of 3 meters, in which cases the minimum width is to be 450mm.
- The slope of the working platform does not exceed 1 meter vertical in 6 meters horizontal.
- The scaffold planks overhang their supports by a minimum of 150mm and maximum of 250mm.
- Guardrails and fender boards are fixed to all open edges of the working platforms above a height of 1.5 meters.

- Guardrails must be between 900 and 1200 mm high with a mid rail located halfway between the work platform and the top rail.
- The toe board must protrude a minimum of 150mm above the working platform to prevent dislodgement of materials and tools .
- All planks are to be closely laid.
- Where practicable planks are to be butt ended rather than lapped. Lapped boards create potential trip hazards.
- All planks forming part of the working platform shall be securely lashed to their supports by a suitable fire retardant lashing. Alternative approved method may be considered.



8.6.3. Safety Harness

All personnel involved in scaffolding work above a height of1.8 meters, where edge protecting is not provided, are required to wear an approved full-body safety harness with double lanyard attached.

It would be impracticable to make a blanket ruling as to when the scaffolder should attach his lanyard to secure anchorage. His need for mobility must be considered but, similarly, his personal safety cannot be compromised. In view of this, scaffolders when working or intending to work aloft shall adopt the following procedures.

- Prior to going aloft, a thorough Job Hazard Analysis shall be undertaken involving the job supervisors and the scaffolder carrying out the work. All work to be carried out in precarious positions shall be identified as areas where 'hooking on' is compulsory. Work methods may need to be modified, or temporary members included, giving the scaffolder an adequate working radius from the anchorage point.
- In addition to areas in the erection and dismantling procedures identified as precarious positions, all work carried out in the stationary position shall require the scaffolder to hook on. Such areas shall include chaining gear up or down, fixing

members from the ‘T’ piece of a drop tube and working on the outboard section of needles.

- Poor work practice and insufficient hazard identification at the job planning stage and during the execution of the job are the major contributors to injuries unless the scaffolder is prepared to place his own preservation first and foremost.
- Taking risks is a finite occupation; eventually it will come to an abrupt end. It cannot be over emphasized that the scaffolder has an important responsibility to eliminate the risk of falling by using his anti-fall protection wherever possible.

8.6.4. Raising and Lowering Gear

All raising and lowering of scaffolding gear must be carried out in a safe and efficient manner.

- The raising or lowering of scaffolding gear shall be carried out by:
  - Human chain
  - Single fall of min 16 mm diameter fibre rope hands held. All ropes to be inspected prior to use.
  - An approved hoisting appliance, ie. Gin wheel.
- Throwing gear is strictly prohibited.
- The area at ground level beneath the gear being raised or lowered shall be barricaded with general purposed bunting and a sign displayed prominently stating

‘Danger – Men Working Above’

- All timber planks intended to be raised or lowered by rope shall be secured with an appropriate hitch ie. Timber hitch with a half hitch above on the main hauling part.
- All tubular members intended to be raised to lowered by rope shall be secured with an approached hitch, round turn two half hitch, round turn two half hitches and half hitch on top.
- All fittings to be raised or lowered are to be contained in an approved lifting device. For small numbers of fittings, a steel bucket in sound condition with reinforced handles will suffice. Large numbers of fittings to be raised or lowered by crane must be contained in a purpose made lifting drum or lifting basket.
- Ground personnel involved in securing gear to be lifted or removing gear that has been lowered shall always remain clear of the gear's trajectory in the events of dislodgment.

8.6.5. Safe Erection, Dismantle & Use of Scaffold

Safe scaffold erection and use should begin by developing policy and work rules. Policy and work rules should concentrate on:

Sound design

The scaffold should be capable of supporting its own weight and at least four times the maximum intended load to be applied or transmitted to the scaffold and components.

Selecting the right scaffold for the job

- Choose a scaffold supplier, rental agency and/or erector who is thoroughly knowledgeable about the equipment needed and its safe use.
- Obtain the owner's manual prepared by the scaffolding manufacturer, which states equipment limitations, special warnings, and intended use and maintenance requirements.

Assigning personnel

Assign a competent person to oversee the scaffold selection, erection, use, movement, alteration, dismantling, maintenance and inspection. Only assign trained and experienced personnel to work on scaffolding. Be certain they are knowledgeable about the type of scaffolding to be used and about the proper selection, care and use of fall protection equipment (perimeter protection, fall protection/work positioning belts and full harnesses, lanyards, lifelines, rope grabs, shock absorbers, etc.).

Training

- Training should focus on proper erection, handling, use, inspection, removal and care of the scaffolds. Training must also include the installation of fall protection, particularly guardrails, and the proper selection, use and care of fall arrest equipment.
- The competent person(s) should receive additional training regarding the selection of scaffolds, recognition of site conditions, scaffold hazard recognition, protection of exposed personnel and the public, repair and replacement options, and requirements of standards.
- Site management personnel should also be familiar with correct scaffolding procedures so they can better determine needs and identify deficiencies.

Fall protection

- Guardrails must be installed on all scaffold platforms in accordance with required standards and at least consist of top rails, mid rails and toeboards.
- Workers on suspended scaffolds must use a fall arrest system as protection against the failure of the scaffold or its components. This system will usually consist of a full body harness, lanyard, rope grab, independent vertical lifeline and an independent lifeline anchorage.
- The full body harness is a belt system designed to distribute the impact energy of a fall over the shoulders, thighs and buttocks.
- It is important to remember that fall protection is only as good as its anchorage. The anchorage points are independent points on structures where lifelines are securely attached.

Guidelines for proper erection

- Supervision of the erection of scaffolding must be done by a competent, skilled, experienced and trained person to ensure safe installation according to the manufacturer's specifications and other requirements.
- Be sure that fall protection equipment is available before beginning erection and use it as needed.
- Examine all scaffold components prior to erection. Return and tag "Do Not Use" or destroy defective components.

- Prohibit or restrict the intermixing of manufactured scaffold components, unless: (1) the components fit together properly, without force, (2) the use of dissimilar metals will not reduce strength, and (3) the design load capacities are maintained.
- All scaffold platforms should be planked as fully as possible with gaps between planks no more than 25.00 mm wide (to account for plank warp and wane).
- Cross braces and scaffold frames shall not be used for access scaffold platforms unless they are equipped with a built-in ladder specifically designed for such purpose.
- All ladders in use must meet OSHA specifications, designed according to standards and secured against displacement. The bottom steps of ladders must not be more than 600 mm from the supporting level.
- Landing Platform/Rest platforms are recommended for at least every 6.0 Meter elevation.

Guidelines for use

- Be certain that scaffolds and components are not loaded beyond their rated and maximum capacities.
- Prohibit the movement of scaffolds when employees are on them.
- Maintain a safe distance from energized power lines.
- Prohibit work on scaffolds until snow, ice and other materials that could cause slipping and falls are removed.

- Protect suspension ropes from contact with sources of heat (welding, cutting, etc.) and from acids and other corrosive substances.
- Prohibit scaffold use during storms and high winds.

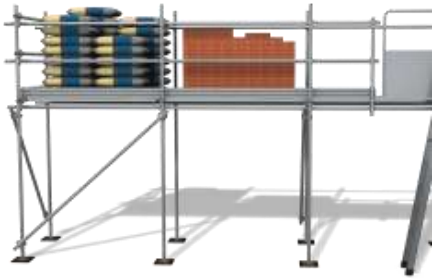
- Remove debris and unnecessary materials from scaffold platforms.
- Prohibit the use of ladders and other devices to increase working heights on platforms.

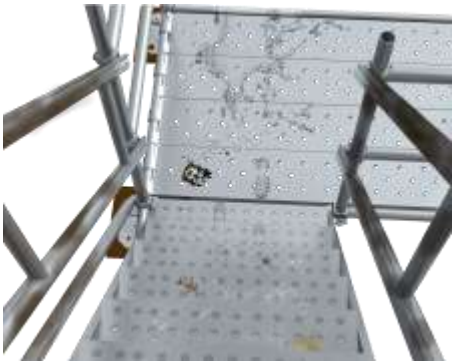
Guidelines for alteration and dismantling

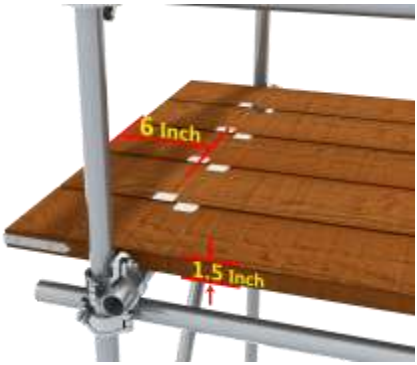
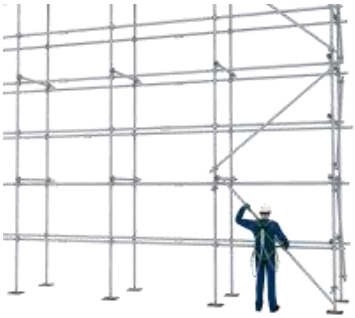
- Require that scaffolds be altered, moved and dismantled under the supervision of a competent person.
- Alteration and dismantling activities should be planned and performed with the same care as with erection.
- Tag any incomplete scaffold or damaged component out of service.

8.6.6. Safe Working on Scaffolding

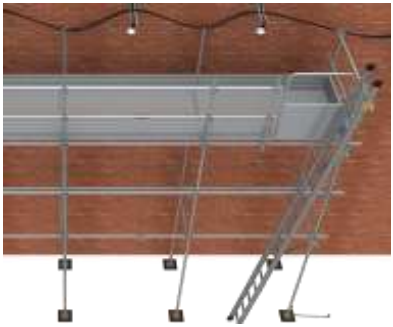
Do's	Don'ts
 Use tubular metallic scaffold of standard design and strength.	 The use of cross brace or frame work as means of access to the working surface should not be permitted

Do's	Don'ts
 Provide guardrail of at least 1 meter & toe board of 15-cm height on scaffolds.	 Barrels, boxes or other unstable object should not be used to support planks used as working platform.
 Provide lateral support to scaffolds if the height is more than 3 times its base or width.	 Scaffold should not be used for storage of heavy materials.

Do's	Don'ts
	
Provide base plate to vertical member & scaffolds if the earth has loose soil.	Persons should not work on scaffolds when platforms or guard rails are slippery and during storm or strong wind.
	
Wear safety belt while working on unguarded scaffolds.	No scaffolds, ladders, working platform, gangways, runs etc. shall exist within 3m of any uninsulated electric wire.

Do's	Don'ts
 The planks used for working platform shall not project beyond the end support to a distance extending four times the thickness of the planks.	 Do not stand on the member of scaffolds (without providing platform) and try to over reach from the scaffolds.
 Cordon off the working area.	 While dismantling scaffold, first do not try to remove the lower bracing of scaffolds.

Do's	Don'ts
 Engineer-in-charge of the work should ensure stability of the scaffold after its erection.	 Do not use scrap wood / packing wood etc as scaffolding planks.
 While working on suspended scaffolds, use a safety belt attached to a life line securely fastened from above.	

Do's	Don'ts
 The planks used for working platform shall be rigidly tied at both ends to prevent sliding and slippage.	
 Whenever electric power and lighting cables are required to run (pass on) through scaffolds or electrical equipment are used, such scaffolds structure shall have two independent earth connections.	

8.7. Case Studies

Case study 01: Fall of person from scaffolding

Description:

A 29-year-old scaffolding foreman died and three co-workers were injured when they fell from the fourth floor of a pump house building that was under construction at a reservoir. The scaffolding foreman and others had been spraying fireproof insulation onto the structural steel frame of the building. They used a mobile scaffold to gain access to the structural steel overhead. Putlogs had been added to the sides of the mobile tower scaffold, and an extension platform had been built there. This platform was used to reach the outer side of the structural steel.

On this day, a supervisor said a guardrail was needed on the scaffold. The scaffolding foreman joined three co-workers working on the extension platform to help installing the guardrail. Their combined weight caused the scaffold to tip and they were fell down on the concrete deck of 14 meter below.

What went wrong

- The scaffold had not been engineered for the extension platform.
- No counterweights, anchorage or bracing were used.
- Neither Scaffolding foreman nor his co-workers were wearing adequate personal fall protection.
- The scaffold and platform had been constructed using parts from different manufacturers.

Recommendations:

- Ensure that scaffolds are assembled according to the manufacturer's recommendations. If locally built, they must be properly designed and engineered.
- Ensure that no extensions or auxiliary parts are added to scaffolds unless designed and approved by an engineer.

- Ensure that workers follow safe work practices when constructing scaffolds.
- Ensure that scaffold load limits given by the manufacturer or engineer are not exceeded.

Case Study 02: Scaffold Collapse Due to Inadequate Bracing

Description:

A construction crew was working on the exterior of a multi-story building using a large independent tied scaffold. The scaffold included a significant cantilevered section to reach a portion of the building's facade. During a windy day, the cantilevered section of the scaffold collapsed, injuring several workers.

What went wrong:

- **Inadequate Bracing:** The cantilevered section lacked sufficient lateral bracing to withstand the increased wind loads.
- **Insufficient Tie-backs:** The scaffold was not adequately tied back to the building to resist lateral forces.
- **Wind Load Underestimation:** The design and erection of the scaffold did not adequately account for the potential impact of high winds in the area.

Recommendations:

- **Adequate Bracing:**
    - Ensure that all scaffold sections, particularly cantilevered sections, are adequately braced to resist lateral forces from wind, vibration, and other sources.
    - Utilize appropriate bracing techniques, such as diagonal bracing, cross-bracing, and tie-backs.
- **Wind Load Considerations:**

- Carefully consider the potential impact of wind loads during the design and erection of the scaffold.
- Consult with qualified engineers and consider local wind data when designing scaffolds in areas with high wind exposure.

- **Regular Inspections:**
  - Conduct regular inspections of the scaffold during use, paying close attention to the stability of cantilevered sections and the integrity of bracing systems.

8.8. Summary & Review Questions

- What is the standard dimension of Base plate as per EN 12811 standard?
- What is the maximum spacing between vertical tie?
- What is the maximum height-base ratio of mobile scaffold?
- All scaffolds must be able to with-stand ____ times the intended load?
- What is the maximum distance to be maintained between the front edge of scaffolding and the face of work?

9. Chapter 2: Scaffold Drawing & Details

Introduction

Scaffold drawings are essential for effective communication and planning. They provide a visual representation of the proposed scaffold structure, including its dimensions, components, and connections. Accurate and detailed drawings are crucial for ensuring that the scaffold is erected correctly and safely.

Scaffold design involves a comprehensive process that considers various factors such as:

- **Load capacity:** The scaffold must be able to safely support the weight of workers, materials, and equipment.
- **Stability:** The scaffold must be stable and resistant to lateral loads (e.g., wind) and other forces.
- **Access and Egress:** Safe and convenient access and egress for workers must be provided.
- **Fall Protection:** Adequate fall protection measures, such as guardrails and nets, must be incorporated into the design.
- **Compliance with Standards:** The scaffold design must comply with relevant safety standards and regulations, including national and international codes of practice.

9.1. Reading and understanding of scaffold drawings.

- **Interpretation:** This involves more than just passively looking at the drawing. It requires active analysis to comprehend the information conveyed.
- **Symbols and Notations:** Understand the meaning of various symbols and notations used in scaffold drawings (e.g., symbols for different components, dimensions, load capacities).

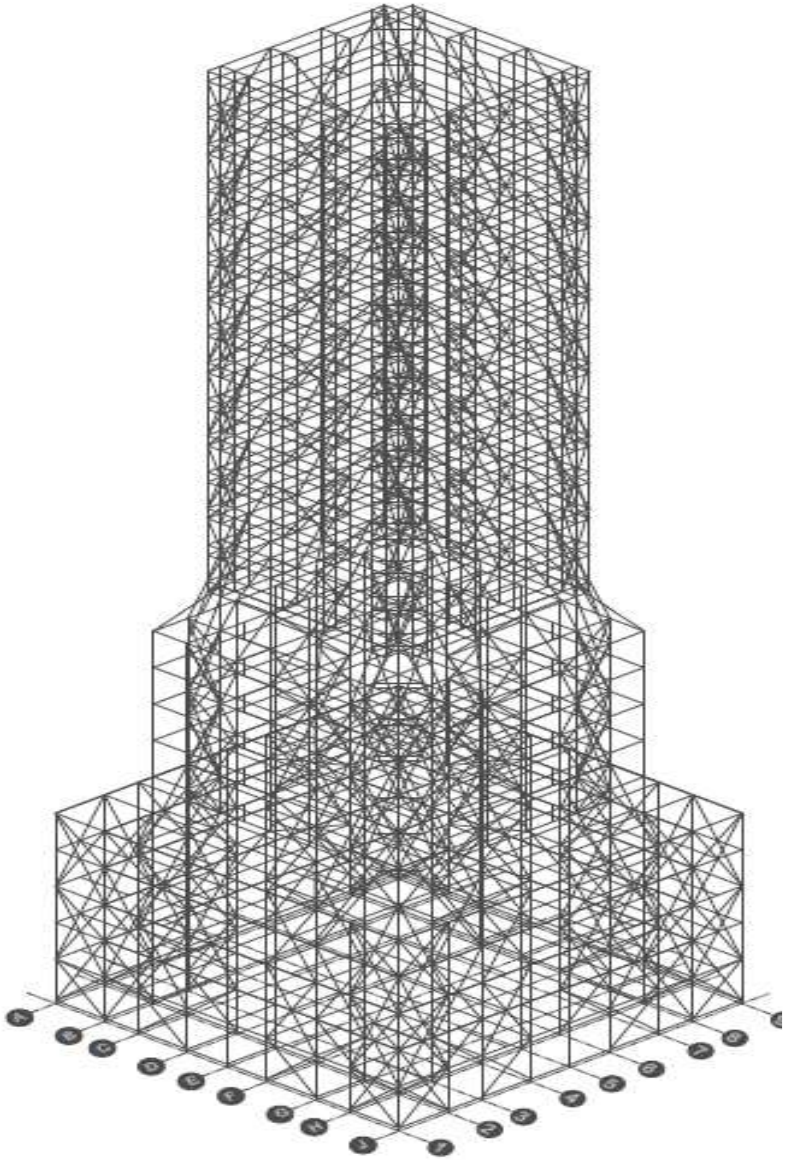
- **Component Identification:** Accurately identify all components depicted in the drawings (standards, ledgers, transoms, braces, platforms, etc.) and their correct placement within the overall scaffold structure.
- **Configuration:** Understand the intended configuration of the scaffold, including its height, width, length, and the arrangement of platforms and access points.
- **Details:** Pay attention to details such as connection types, bracing configurations, and the use of specific components.

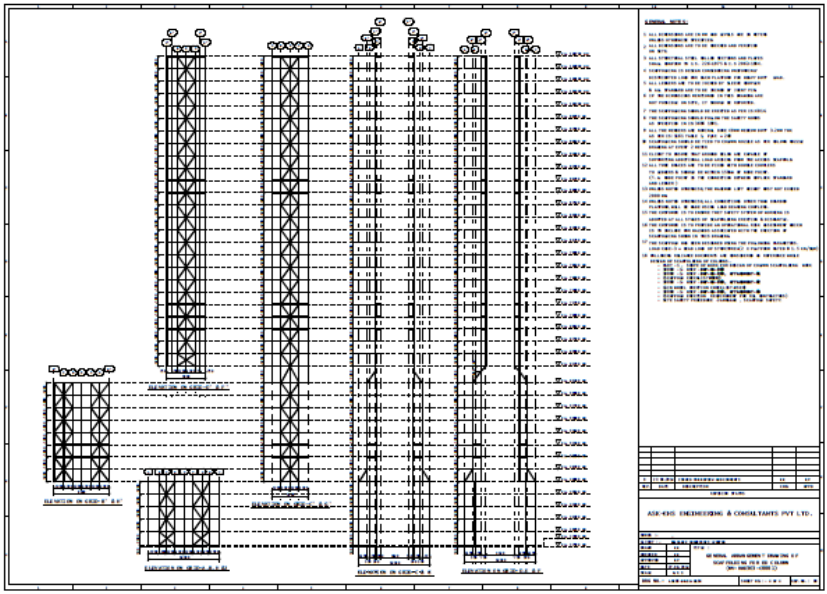
9.1.1. Interpretations of scaffold drawings.

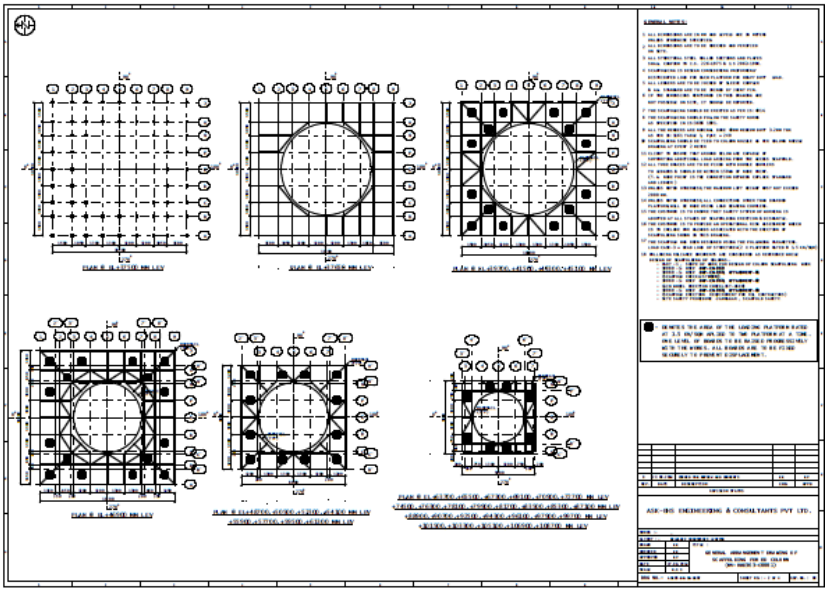
- **Visualization:** Mentally construct the 3D scaffold structure from the 2D drawings.
- **Visualize Erection:** Imagine the process of erecting the scaffold based on the drawings.
- **Identify Potential Issues:** Anticipate potential challenges or difficulties during erection based on the drawing interpretations.
- **Discrepancies:** Identify any inconsistencies or errors in the drawings, such as missing dimensions, conflicting information, or unrealistic configurations.

9.1.2. Provide assistance in preparations of Scaffold drawings.

- **Collaboration:** Work closely with engineers or designers to develop accurate and comprehensive scaffold drawings.
- **Information Gathering:** Collect necessary information from the site, such as dimensions, ground conditions, and access requirements.
- **Input and Suggestions:** Provide valuable input and suggestions to improve the design and clarity of the drawings.
- **Quality Control:** Assist in reviewing drawings for accuracy, completeness, and adherence to relevant standards.







9.2. Scaffold Design

9.2.1. Working out of design details of scaffolds as per Indian Standards for supported & mobile scaffoldings up to 20 meters height.

- **Design Principles:** Apply the principles of Indian Standards (IS codes) for the design of supported and mobile scaffolds up to 20 meters in height.
- **Load Calculations:** Perform basic load calculations considering dead loads (scaffold weight), live loads (workers, materials), and potential environmental loads (wind).
- **Stability Analysis:** Evaluate the stability of the scaffold design, ensuring adequate bracing and support.
- **Access and Egress:** Incorporate safe access and egress points (ladders, stairways) into the design.
- **Component Selection:** Select appropriate components (standards, ledgers, couplers) based on the design loads and the requirements of Indian Standards.

9.2.2. Working out of design details of scaffold as per International Standards of OSHA & BS standards for supported & mobile scaffoldings up to 20 meters height.

- **International Standards:** Understand the specific requirements and guidelines of OSHA (Occupational Safety and Health Administration) and BS (British Standards) for scaffold design.
- **Comparative Analysis:** Compare and contrast the requirements of different international standards.
- **Adaptability:** Adapt the scaffold design to comply with the specific requirements of OSHA, BS, or other relevant international standards.

- **Consider International Best Practices:** Incorporate internationally recognized best practices in scaffold design into the design process.

9.2.3. Checking of design details of scaffolds provided to him.

- **Critical Review:** Carefully review scaffold designs prepared by others, paying close attention to details.
- **Compliance Check:** Verify compliance with relevant standards (Indian Standards, OSHA, BS, etc.).
- **Hazard Identification:** Identify potential hazards and safety concerns in the design.
- **Feasibility Assessment:** Evaluate the feasibility of the design in terms of construction, cost, and practicality.
- **Recommendations:** Provide constructive feedback and recommendations for improving the design.

9.3. Case Studies

Case Study 01: Scaffold Collapse Due to Inadequate Ground Support

Description:

A construction site was utilizing a large independent tied scaffold for exterior wall work on a multi-story building. The scaffold was erected on a sloped site with uneven ground. To compensate for the slope, wooden blocks were placed under the base plates of some standards to level the scaffold.

What went wrong:

- **Inadequate Ground Assessment:** A proper geotechnical assessment of the ground conditions was not conducted. This

resulted in an inadequate understanding of the soil's bearing capacity.

- **Insufficient Ground Support:** The use of wooden blocks for levelling was a temporary and inadequate solution. The blocks were not designed to support the significant loads imposed by the scaffold.
- **Lack of Proper Anchoring:** The scaffold was not adequately anchored to the ground to resist lateral loads (e.g., wind).
- **Inadequate Supervision:** There was a lack of adequate supervision during the erection process, leading to potential errors in assembly and ground support.

Recommendations:

- **Thorough Site Assessment:** Always conduct a thorough site assessment, including a geotechnical evaluation, before erecting any scaffold.
- **Proper Ground Support:** Ensure adequate ground support for the scaffold, using appropriate methods such as concrete pads, screw piles, or other suitable foundations.
- **Adhere to Design Plans:** Strictly adhere to the approved scaffold design and ensure that the erection process follows the design specifications.
- **Competent Supervision:** Ensure that qualified and experienced personnel supervise all stages of scaffold erection and dismantling.
- **Regular Inspections:** Conduct regular inspections of the scaffold throughout its use to identify and address any potential issues.

Case Study 02: Scaffold Collapse Due to Inadequate Design - Cantilevered Section Failure

Description:

A construction project involved the renovation of a historic building. The project required the erection of a cantilevered scaffold to access the upper floors of the building. The design of the cantilevered section did not adequately account for the increased stresses and moments associated with the extended overhang.

What went wrong:

Inadequate Structural Analysis: The design calculations failed to accurately assess the stresses and moments induced in the cantilevered section due to the extended overhang and the anticipated loads.

Insufficient Bracing: The cantilevered section lacked adequate lateral bracing to resist the increased forces.

Overloading: The scaffold was overloaded during use, exceeding the design capacity of the cantilevered section.

Recommendations:

- Conduct thorough structural analysis of all scaffold components, especially for complex configurations such as cantilevered sections.
- Utilize appropriate engineering software and consider factors such as wind loads, vibration, and potential dynamic loads.
- Ensure that adequate bracing is provided to resist lateral forces and maintain the stability of cantilevered sections.
- Accurately determine the anticipated loads on the scaffold and ensure that the design can safely support these loads.
- Implement load management measures to prevent overloading of the scaffold.
- Conduct regular inspections of the scaffold during use to identify any signs of distress or instability, especially in critical areas like cantilevered sections.

9.4. Summary & Review Questions

- What is the load capacity of Heavy-duty scaffold as per EN 12811 standard?
- What is live load in scaffolding?
- Which of the following is not a load bearing component in scaffolding?
- What is the standard dimension of Base plate as per EN 12811 standard?
- What is the load capacity of Light-duty scaffold as per EN 12811 standard?

10. Chapter 3: Basic Scaffolding Design

Introduction

Basic scaffold design involves the application of sophisticated engineering principles and a deep understanding of complex structural systems. This includes the design and analysis of:

- Independent scaffolds: Tube & fitting, Cuplock system that normally used in various industries.
- Suspended scaffolds: Systems that hang from the structure being worked on, often used for high-rise buildings.
- Cantilevered scaffolds: Structures that extend horizontally beyond the support structure, requiring careful consideration of stability and anchorage.
- Multi-tiered scaffolds: Complex structures with multiple levels and platforms.
- Specialized scaffolds: Designed for specific tasks and environments, such as those used for bridge construction, industrial maintenance, and offshore platforms.

This section will delve deeper into the principles and practices of basic scaffold design, focusing on the critical competencies required for professionals involved in the design and evaluation of these complex structures.

This introduction emphasizes the unique challenges and complexities associated with basic scaffold design, setting the stage for a detailed discussion of the relevant competencies

10.1. Independent Tube and Fitting Scaffolding

An independent scaffold consists of two rows of standards, joined longitudinally by ledgers and transversely by transoms and / or putlogs and is braced and tied to form a rigid stable structure. Exceptions can apply to these guidelines. When this occurs, the scaffold will have a Structural Engineers calculations attached to the designers drawings. The Calculations will designate all load factors such as wing and load bearing.

10.1.1. Bay Sizes

- Heavy Duty 1.8m x 1.5m
- Medium Duty 2.4m x 1.5m
- Light Duty 3.0m x 1.5m

10.1.2. Loadings

One working platform in a bay of independent tube and fitting scaffolding shall not be loaded in excess of the following:

- Heavy Duty 250 kg/M2
- Medium Duty 200 kg/M2
- Light Duty 150 kg/M2

The load to be placed on the working platform is to be distributed evenly over the area of the working platform but any concentrated loading is to be borne by the standards.
No more than two working platforms are to be fully loaded per bay but this number may be increased provided the total loading per bay does not exceed the total of two fully loaded bays.

10.2. Independent Modular Scaffolding

Modular scaffolding consists of prefabricated members that lock together using a variety of patented fixing points located at approximately 0.5 metre intervals on the standards.

10.2.1. Bay Sizes

Standard spacing for modular scaffolding may vary from those set down for tube and fitting scaffolding provided approval has been granted by the Department of Occupational Health, Safety and Welfare. An example of this variation is the 2.4m transoms available in the wedge-lock system that enable the scaffolder to erect 2.4m x 2.4m medium duty bays.

Standard spacing are limited to the following:

- Heavy Duty 1.8m x 1.5m
- Medium Duty 2.4m x 1.5m
- Light Duty 3.0m x 1.5m

10.2.2. Loadings

One working platform in a bay of independent modular scaffolding shall not be loaded in excess of the following:

- Heavy Duty 250 kg/M2
- Medium Duty 200 kg/M2
- Light Duty 150 kg/M2

The load to be placed on the working platform is to be distributed evenly over the area of the working platform but any concentrated loading is to be borne by the standards.

No more than two working platforms are to be fully loaded per bay but this number may be increased provided the total loading per bay does not exceed the total of two fully loaded platforms.

10.3. Tower Scaffolding – Tube and Fitting

A tower scaffolding consists of four standards joined together longitudinally by ledgers and transversely by transoms and / or putlogs and is braced and tied to form a rigid stable structure. A tower is basically four parallel trusses on end and joined in the form of a box to support a working platform

10.3.1. Bay Sizes

- The minimum base dimension of a tower is 1.2m x 1.2m
- The maximum base dimension of a tower is 3.0m x 2.4m

Height

The maximum height of a freestanding tower is three times the least base dimension measured centre to centre of the standards.

- The maximum height of a tied tower is 45 metres.
- The maximum height of a guyed tower is 15 metres.

10.3.2. Loadings

Not more than one working platform shall be erected on a tower scaffold although intermediary-landing platforms may be erected for access to the working platform. The working platform on a tower scaffold shall not exceed the following loadings:

- Heavy Duty 250 kg/M2
- Medium Duty 200 kg/M2
- Light Duty 150 kg/M2

Bracing

Diagonal face bracing will be installed progressively on all faces of a tower scaffold. Where it is not possible to install such face bracing due to protrusions from the building, that face will be tied in the manner diagonal plan bracing shall be installed at every third lift of the tower scaffolding to the full height of the tower scaffolding.

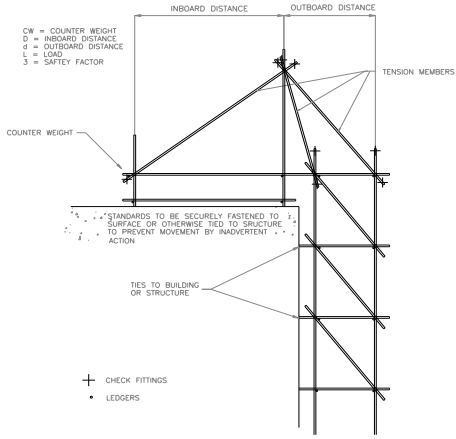
Access Towers

Where the tower scaffolding is erected to proved access to a work area above 6 metres in height, the landing places for the ladders must be fully decked (except when access is provided).
The maximum spacing between landing places shall be 4 metres.

10.4. Drop Scaffolding

A drop or hanging scaffold consists of two or more rows of puncheons, joined longitudinally by ledgers and transversely by transoms and putlogs and braced to form a rigid stable structure that is secured to overhead supports of sufficient capacity to withstand any load likely to be imposed on such overhead supports.

A drop scaffold is erected where it is not possible, or it is not practicable to erect a scaffold from the ground.



10.4.1. Drop Tube Spacings

The maximum spacing of drop tubes supporting the working platforms of a hanging scaffold shall be as for medium duty and light duty independent tube and fitting scaffold. Unless otherwise designed.

- Medium Duty 2.4m x 1.5m
- Light Duty 3.0m x 1.5m

Any work to be performed from the working platform of a drop scaffold requiring the drop scaffold to be erected to heavy-duty specifications shall only be erected with prior Manager approval.

10.4.2. Loadings

One only working platform per bay of drop scaffolding shall be loaded at any one time and such working platform shall not be loaded in excess of the following:

- Medium Duty 200 kg/M2
- Light Duty 150 kg/M2

Grid Mesh

Grid mesh may be used as an overhead support for drop tubes. An approved closed eye bracket welded to the end of the scaffold tube shall be retained in the grid mesh by a mild steel pin 20mm in diameter and 400mm in length. The pin shall be prevented from movement or dislodgement through inadvertent action by being lashed securely to the grid mesh with a suitable fire-retardant lashing.

Prior to raising or lowering the drop tubes into position a short tube approximately 300mm shall be fixed with a 90-degree coupler to the lower end of the drop tubes. This short tube affords the scaffolder a degree of comfort when erecting the initial ledgers and transoms and shall not be substituted by a 90-degree coupler.
Scaffolders are permitted to access the lower end of the drop tube by sliding down the tube to the 'T' piece or by walking the steel beams if the former is not practicable.

Beams used as Overhead Supports

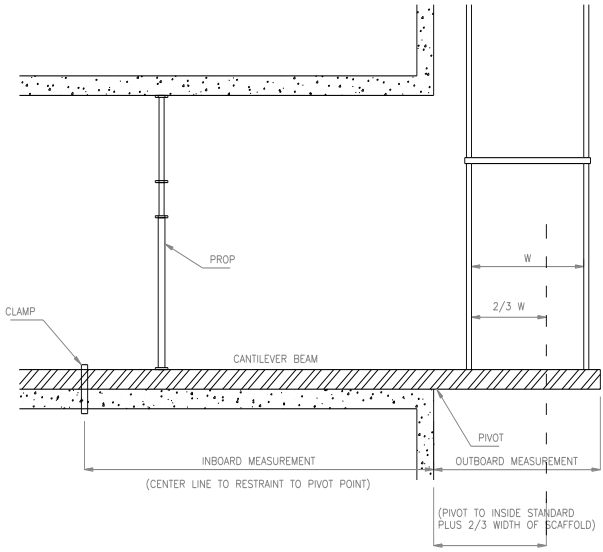
Structural beams provide excellent opportunities for overhead supports for drop scaffolding. Purpose made beam clamps only are to be used to lock tubes onto or into 'I' beams. Tubes may be placed above or below the flanges of the beams or positioned inside the web of two parallel beams. In all cases they will be locked in position using beam clamps.
Drop tubes are fixed to the horizontal tubes that are fixed to the beams using inverted 90-degree couplers and a check fitting

positioned immediately adjacent to and above that fitting.

In some cases it may be necessary to build temporary platforms to reach the next beam to be used as an overhead support. Temporary platforms can be spurred back to existing members to provide access to previously inaccessible beams. The scaffolder should always be prepared to erect temporary accesses to eliminate dangerous work practices. Scaffolders are not assessed on their ability to take risks but their ability to perform their duties in a safe and efficient manner.

10.5. Cantilever Scaffolding

Cantilever scaffolding is supported by large cantilevered beams, projecting from a building or structure with an inboard restraint capable of withstanding a force at least 3 times the outboard load.



10.5.1. Bay Sizes

- Heavy Duty 1.8m x 1.5m
- Medium Duty 2.4m x 1.8m
- Light Duty 3.0m x 1.5m

10.5.2. Loadings

Not more than two working platforms are to be erected and fully loaded per bay of scaffolding supported by cantilevered beams.

- Heavy Duty 250 kg/M2
- Medium Duty 200 kg/M2
- Light Duty 150 kg/M2

10.5.3. Erection

All gear to be used in the erection of a cantilevered scaffold is to be laid out neatly and sorted into sizes for easy access. It will be necessary to erect general-purpose bunting around the work area and at ground level beneath the work area to warn personnel of an overhead hazard.

A sign must be displayed prominently at ground level sign stating 'Danger – Men Working Above'.

10.5.4. Positioning Beams

The basis of all cantilever scaffolds is the needle beams and as such is critical to the safe erection of the scaffold.

The job safety analysis discussion between the competent scaffolder and supervisor should cover the following points regarding the beams:

- The dimensions of the beam
- The ability of the pivot point to support the combined forces of the inboard and outboard.
- The ability of the inboard restraint to withstand three times the

force of the load outboard.

- The method to be employed to eliminate any lateral movement from the beams.
- The first three points mentioned above require an Engineer's verification.

The beams are positioned the required distance apart according to the standard spacing of the scaffold and projected the required distance outboard from the building or structure. The outboard distance is calculated from the desired width of the working platform plus the clearance required from the building or structure to the working platform, plus 200mm. The inboard restraint toms / props are installed to prevent any movement.

On completion of the inboard restraint of the beams, the scaffold can be erected on the projecting portion of the needles. All work to be performed on the outboard requires the scaffolder to secure his anti-fall lanyard to a secure anchorage. If a secure anchorage is not available, a temporary tom is to be installed for this purpose.

10.5.5. Erection Of The Outboard

A minimum of two boards is to be laid on the needles to afford the scaffolder a degree of comfort when erecting the scaffold. The standards are to be located on base plates welded to the beams at the required spacing. Ledgers are to be erected as close to the base of the standards as possible and secured to the top flange of the beam with purpose made beam clamps. The scaffold is erected as for the tube and fitting independent scaffolding with attention being paid to ties and bracing.

The following formula is used to find the unknowns: Formulas for levers of the 1st order:

1. $$\frac{\text{Outboard} \times \text{Load} \times \text{SF}}{\text{Inboard}} = \text{CWT}$$

2. $$\frac{\text{Load x Outboard x 3}}{\text{CWT}} = \text{Inboard}$$

3. $$\frac{\text{Inboard x CWT}}{\text{Load x SF}} = \text{Outboard}$$

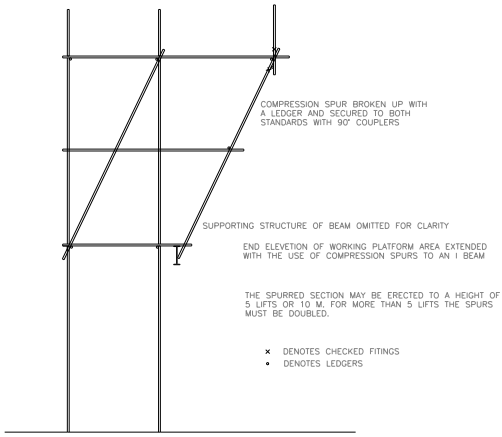
4. $$\frac{\text{Inboard x CWT}}{\text{Outboard x SF}} = \text{Load}$$

SF = 3

When calculating the outboard load the mass of the components of the scaffold must be considered as they make up part of the load. The outboard distance is calculated as the clearance from the pivot points to the inside standard of the scaffold plus 2/3 the width of the scaffold.

10.6. Spur Scaffolding

Spur scaffolding is an independent type of scaffolding, which does not rest upon the ground but is cantilevered from the face of the building, structure or another scaffold. Because they have the support of spurs or struts, the needles do not have to be large section beams, nor are counterweights needed. Scaffold tubes can be used throughout, but the structure must be correctly designed.



As the spur scaffold is basically an independent scaffold, the bay sizes and loadingsof independent tube and fitting shall apply.

10.6.1. Erection

Spur scaffolding has many applications and forms. However, the basic principle of the outside row of standards being supported by compression spurs applies.

The diagram following this section shows the spurs being supported in the web of a beam to extend the area of working platform on an existing scaffold. The outboard sections of the needles are extensions of the transoms and as such are supported by 90-degree couplers on the standards with the ledgers acting as

checks. The needles projection from the independent scaffold each has a safe working load of approximately 133 kg when the load is evenly distributed along their length. Therefore it is quite safe to lay planks on the needles to provide a comfortable working platform on which the scaffolder can erect the spur scaffold. However, if support is required for the outboard needles, temporary members should be employed.

Prior to any work commencing on the outboard, the scaffolder must attach anti-fall protection to a secure anchorage. In this example the standards of the independent scaffolds would provide a secure anchorage. The procedure for erecting the puncheons is to fix them with 90-degree couplers to the needle at the required distance outboard. The ledger is then under-slung onto the standards with 90-degree couplers. This method is far superior to fixing the ledger on top of the needles and the puncheons to the ledger. By under-slinging the ledger to the puncheons the scaffolder has effectively fixed the puncheon in 2 places. The spurs can now be set into the web of the beams and fixed to the under-slung ledger loosely so as to allow movement. The needles are levered up to level using a plank on its edge and the main scaffold as a fulcrum and the fitting nipped up.

The maximum length of the tube in compression shall be 2 metres. Therefore the spur, being in compression, must be broken up, as in the diagram it is approximately 2.5 metres. Fixing a ledger through the longitudinal plane and securing the spur to the standards in the transverse plane as illustrated achieve the breaking up effect.

A ledger must also be fixed at the foot of the spur to prevent any lateral movement of the spur. On completion of the support structure of the spur scaffold, the required lifts can be erected as for an independent scaffold. These basic principles of spur scaffolding apply to all applications regardless of the structure.

10.7. Mobile Scaffolding - Tube And Fitting

A mobile scaffold consists of four or more standards joined together longitudinally by ledgers and transversely by transoms and putlogs and are supported by approved castors. The scaffold is braced in all faces to form a stable rigid structure.

10.7.1. Bay Sizes

- Heavy Duty 1.8m x 1.5m
- Medium Duty 2.4m x 1.8m
- Light Duty 3.0m x 2.1m

10.7.2. Loadings

Not more than one working platform shall be erected on a mobile scaffold although intermediary-landing platforms may be erected for access to the working platform. The working platform on a mobile scaffold shall not exceed the following loadings:

- Heavy Duty 250 kg/M2
- Medium Duty 200 kg/M2
- Light Duty 150 kg/M2

Height

The maximum height of the working platform on a mobile scaffold is 3 times the minimum base dimension. It will be seen that this requirement will make it necessary to increase the base area of the scaffold in order to erect the working platform to a height greater than would be permitted by the area of one bay.
When the base of a mobile scaffold is extended, the centre of the working platform must be located vertically above the centre of the base, providing that:
When a wall, or the like, prevents the extension being used on one side, the base on the opposite side shall be extended to give the required ratio.

10.7.3. Castors

No castor shall be used on a mobile scaffold unless it meets the following:

- The SWL is clearly stamped
- Pneumatic tyres prohibited
- Safe lock device
- Minimum diameter 125mm
- Eccentricity between the centre of the castor and centre of the shank is not greater than 60mm
- Shank is not less than 150mm in length and be able to be properly secured in the standard

10.7.4. Bracing

Diagonal face bracing shall be installed progressively on all faces of a mobile scaffold. Diagonal plan bracing shall be installed in the base lift as close to the castors as practi- cable and coupled in the centre using a swivel coupler. Plan bracing shall be further located in every third lift.

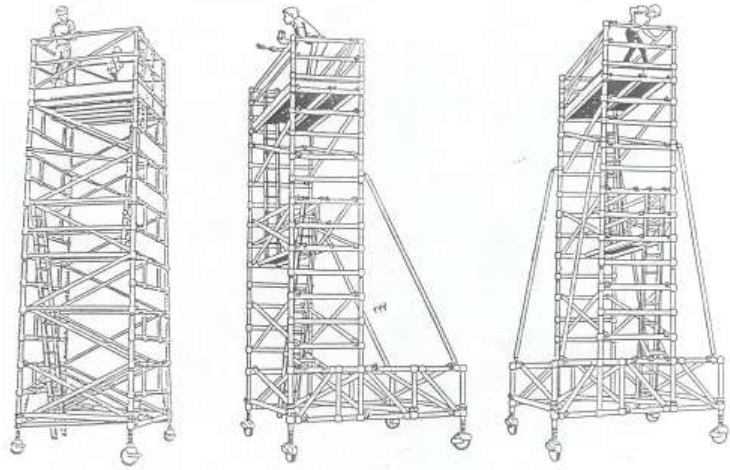


FIGURE 7.4 TYPICAL MOBILE SCAFFOLDS

10.8. Bird Cage Scaffolding

Birdcage scaffolding consists of more than 2 rows of standards joined together by ledgers, and transoms or putlogs, and braced and tied to form a rigid stable structure. Birdcage scaffolding is used to gain access to ceilings, soffits and walls.

10.8.1. Bay Sizes

- Heavy Duty 1.8m x 1.5m
- Medium Duty 2.4m x 1.8m
- Light Duty 3.0m x 2.1m

10.8.2. Loadings

Should there be a need for more than one working platform it is permissible to erect a maximum of two. One working platform should not be loaded in excess of the following:

- Heavy Duty 250 kg/M2
- Medium Duty 200 kg/M2
- Light Duty 150 kg/M2

10.8.3. Bracing

Diagonal bracing is to be provided on all faces of the scaffold and, where necessary, internally to ensure a rigid scaffold. Where a birdcage scaffold is erected within a confined area, butt tubes may be used in addition to, or in substitution of, other bracing or ties, if the wall surface permits. In some cases the ledgers and transoms can butt against the wall to give the scaffold rigidity.

10.8.4. Working Platform

Except where access is provided, the working platform on a birdcage scaffold is to be closely planked at all times.
If there are insufficient planks to closely plan the whole area of the working platform then the area not covered shall be guard railed at the open edge.

10.9. Case Studies

Case study -01: Scaffold pipe fell on ground during shifting to higher location by man chain process, causing fatality.

Description:

Scaffolding erection was in progress at 40m height elevation on crude column. A group of scaffolder was engaged for shifting scaffold pipes to 40m height for erection of the scaffold. A 6m pipe was being shifted from ground to 40m height on column by man chain process by scaffold group. When pipe shifted just below elevation of 40m height column, further a workman passed pipe to workman who was standing on 40m elevation. During the process workman at 40m level failed to firmly hold the pipe before which the person below left it loose. Pipe fell down directly from 40m height to ground and hit the head of a welder who was performing welding on ground in same column and became penetrate in welder head. Welder succumbed to the injury on the spot.The hit was very severe, it broke the welders face shield and further penetrated into head, causing fatality on the spot.

What went wrong?

- Scaffold pipes were shifted to higher elevation with wrong method, man chain method.
- Very unsafe activity was done and allowed at ground level just below the erection site.
- It was a case of very poor supervision.
- PTW filled up for name sake, control measures not taken.
- Clear instructions not given to the concerned workmen TBT at work site.

Precautionary Measures:

- Right method (Gin wheel arrangement) need to be followed up to shift the scaffold materials to higher elevation.

- Underneath area of scaffold erection should be hard barricaded with sign board indicating scaffold erection under progress.
- Concern supervisor availability should be ensured at erection/dismantling location.
- Adhere with Permit to work system rigorously.
- Each and every points of scaffold need to be covered in TBT to make awareness amongst the workmen.

Case Study No: 02: Rebar kept inside Ledgers during scaffold dismantling fell down resulting in fatality.

Description:

A group of scaffolders were deployed for dismantling the scaffold at 10m height. One of the scaffolder removed one ledger pipe during the course of dismantling. After removing the ledger, as he lowering the pipe, a 10mm dia and 2m long rebar kept inside by some other group slipped and fell down and hit workman at head who was engaged in civil work on ground. The rebar broke the helmet and penetrated in workman's head. Workman succumbed to the injury on the spot.

What was wrong?

- Underneath Area was not barricaded before dismantling the scaffold.
- The activities at the ground level below the scaffold was not stopped
- Scaffolder failed to monitor for any loose materials kept inside ledgers.
- Permit process was neglected.
- This point was not discussed in TBT by the supervisor that no loose materials should be kept hidden inside the scaffold pipes.

Precautionary Measures:

- Before dismantling the scaffold, underneath area should be barricaded with sign board.
- Conflicting activities should be avoided with strict supervision.
- Ledger/Transoms pipes inside part need to be checked before clamp out scaffold pipes.
- Permit to work system need to be followed up strictly.
- Hazards involved in erection/dismantling activities need to be discussed amongst the workmen in TBT.

10.10. Summary & Review Questions

- At what height the kicker lift/ base lift can be provided?
- What is the maximum load you would lift with a gin wheel?
- How scaffold stability can be achieved?
- Which of the following is not a load bearing component in scaffolding?

11. Chapter 4: Scaffolding Inspection

11.1. Introduction

Scaffolding is a critical component of many construction and maintenance projects, providing safe access for workers at height. However, even the most carefully designed and erected scaffold can pose significant risks if not properly inspected and maintained. Regular and thorough inspections are essential to identify potential hazards, ensure the structural integrity of the scaffold, and prevent accidents.

This section will delve into the critical role of scaffolding inspection, exploring the key principles, procedures, and best practices for conducting safe and effective scaffold inspections. It will cover various aspects of the inspection process, including:

- **Visual inspection:** Thoroughly examining all components of the scaffold for signs of wear, tear, damage, or defects.
- **Structural integrity checks:** Assessing the scaffold's stability, load-bearing capacity, and resistance to lateral forces.
- **Fall protection assessments:** Evaluating the effectiveness of guardrails, mid rails, toeboards, and other fall protection systems.
- **Compliance checks:** Ensuring compliance with relevant safety regulations, standards, and best practices.
- **Documentation and reporting:** Preparing detailed inspection reports and communicating findings effectively.

11.2. Types & stages of Scaffold Inspection:

Scaffolding plays a critical role in many construction and maintenance projects, providing safe access for workers at height. However, even the most carefully designed and erected scaffold can pose significant risks if not properly inspected and maintained. Regular and thorough inspections are essential to identify potential hazards, ensure the structural integrity of the scaffold, and prevent accidents.

Following are the types & stages of inspection:

- Pre-Erection Inspection
- During Erection Inspection
- Handover Inspection
- Pre-Dismantling Inspection
- During Dismantling Inspection

11.2.1. Pre- Erection Inspection

Material Inspection

- All materials should be inspected by a competent person before use.
- The inspection should be performed before dispatch to the site or upon arrival at the site.
- An area should be set aside for damaged or defective material.
- Signs should be erected indicating that the material is defective and is not to be used.

Check followings while inspection.

- solid foundations
- stable conditions
- complete working platforms
- Rest platforms
- suitable anchorage points
- guardrails
- loose connections
- tie-off points
- damaged components
- proper access
- use of fall protection equipment.

Checklist for Materials before use:

Site:.....

Location: .....

Date: ...../...../..... Copies to: .....

Item	Quantity	Comments	Acceptable (Y/N)
Sole Boards			
Base Jacks			
Base plates			
Standards			
Ledgers			
Transoms			

Item	Quantity	Comments	Acceptable (Y/N)
Intermediate Transoms			
Right Angle Couplers			
Scaffold Tube			
Decking			
Diagonal Braces			
Access stairs or ladders			
Cantilever Bracket Assemblies Bridging Ledger			
Erection and Use Instructions			
Other Components			

Worksite Inspection

- Take any and all necessary precautions to ensure that the public are not endangered.
- This may entail the erection of diversion barriers and signs.
- Special care should be taken when working in the close vicinity of overhead or adjacent power cables.
- If possible contact someone in authority on site to inform them that you are commencing erection.
- Ensure not to obstruct essential services such as hydrants, service manholes or fire exits.

- Ensure that you are in possession of all necessary permits and information relating to the job prior to commencing erection.

11.2.2. During Erection Inspection

- Inspect all scaffolds and components before they are brought to the erection location.
- Separate out the damaged components, tag them “Do Not Use” or destroy defective components.
- Inspect scaffolds before use and attach a tag stating the time and date of inspection.
- Inspect scaffolds before each work shift
- Inspect the scaffold especially after changing weather conditions and prolonged interruptions of work.
- Ensure that all standards are correctly aligned and properly supported at their bases.
- There is no undue deflection in ledgers, transoms or putlogs.
- No essential member of the structure has been removed.
- All ties and braces are effective in stabilizing the structure.
- All couplers are tightened properly.
- All scaffold planks are sound and are properly supported.
- All guardrails and toe boards are secured in place.

- All ladders are in good condition and properly secured.
- Warning signs or notices such as **"INCOMPLETE SCAFFOLD"** or **"UNSAFE SCAFFOLD"** should be prominently displayed.

The factors to be considered during inspection:

Plumb:

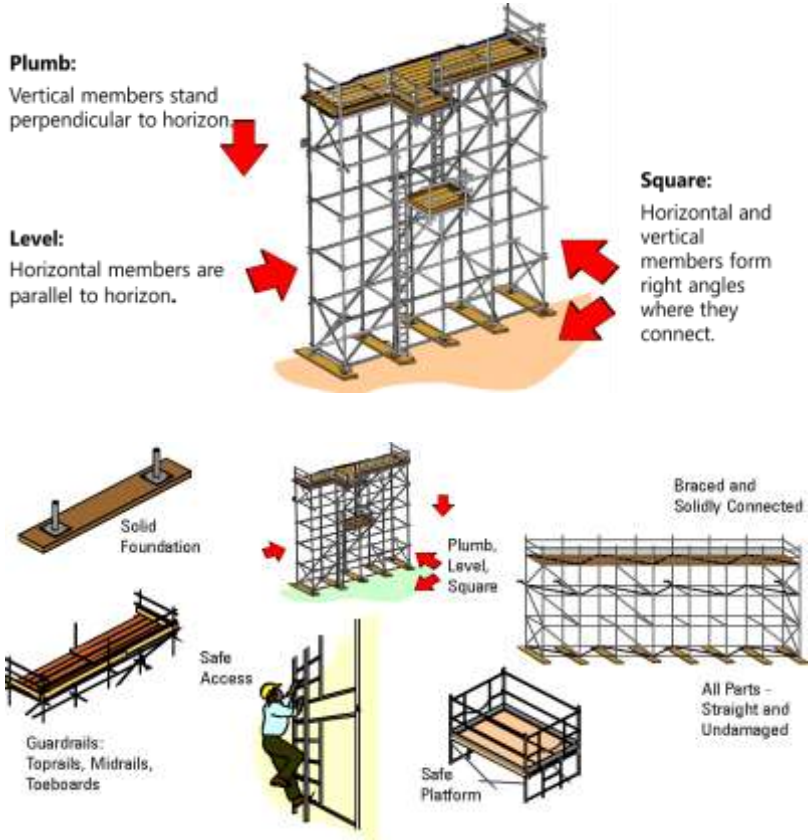
Vertical members stand perpendicular to horizon.

Level:

Horizontal members are parallel to horizon.

Square:

Horizontal and vertical members form right angles where they connect.



Structural inspection

- Suppliers and owners of site/location must ensure their site is without risk to health when used properly.
- Procedures for the regular inspection of new and re-used equipment should be developed and implemented to ensure defects and structural damage is detected.

11.2.3. Handover Inspection

The "Handover Inspection" in scaffolding refers to the formal process of transferring responsibility for the erected scaffold from the scaffolding contractor to the entity that will be using it (e.g., the main contractor, the client).

The person responsible for the erection of the scaffold should provide the relevant person or principal contractor with a handover certificate which is kept on site until the scaffold has been dismantled.

The "Handover Inspection" in scaffolding refers to the formal process of transferring responsibility for the erected scaffold from the scaffolding contractor to the entity that will be using it (e.g., the main contractor, the client).

Key Aspects of Handover Inspection:

- **Completion of Scaffold Erection:** The scaffold must be fully erected and inspected by a competent person (e.g., a scaffolding supervisor) before handover.
- **Safety Check:** A thorough safety check must be conducted to ensure the scaffold complies with all relevant safety standards, regulations, and design specifications.
- **Documentation:**
  - A "Handover Certificate" is a crucial document.
  - This certificate formally records the completion of the scaffold erection and its acceptance for use.

- It typically includes details such as:
    - Date of erection completion
    - Scaffold type and dimensions
    - Name and contact information of the scaffolding contractor
    - Name and contact information of the person receiving the scaffold
    - Confirmation that the scaffold has been inspected and deemed safe for use
    - Any specific limitations or restrictions on the use of the scaffold
- **Record Keeping:** The handover certificate is a vital document that must be kept on-site throughout the duration of the scaffold's use.
- **Responsibility Transfer:** The handover certificate signifies the transfer of responsibility for the scaffold's safe use from the scaffolding contractor to the entity using it. This includes the responsibility for ongoing inspections and maintenance.

Benefits of Handover Inspection and Certification:

- **Improved Safety:** Ensures the scaffold is safe for use before workers access it.
- **Clear Responsibility:** Clearly defines the responsibilities of the scaffolding contractor and the user.
- **Documentation:** Provides a clear record of the scaffold's construction and inspection history.
- **Legal Compliance:** Helps ensure compliance with relevant safety regulations and industry standards.

By implementing a formal handover process, including the issuance of a handover certificate, construction companies can

significantly enhance the safety and efficiency of their scaffolding operations.

Scaffold Handover Certificate

Alteration No.

Date

HANDING OVER

11.2.4. Pre-Dismantling Inspection

The **Pre-Dismantling Inspection** is a crucial step in ensuring the safe and efficient dismantling of a scaffold. It's conducted before any dismantling work begins.

- Develop a safe and efficient dismantling plan, including:
  - The sequence of dismantling operations.
  - The use of appropriate lifting equipment and tools.
  - The placement of materials during dismantling to prevent damage.
  - The allocation of personnel to specific dismantling tasks.
- Thoroughly inspect the entire scaffold for any signs of damage, wear and tear, or deterioration that may have occurred during use.

- Check for any loose connections, missing components, or evidence of overloading.
- Pay close attention to the condition of platforms, guardrails, and fall protection systems.
- Re-evaluate the stability of the scaffold, considering any potential changes in loading conditions or environmental factors since the last inspection.
- Before dismantling, examine and check the scaffold to ensure that all ties and bracing are effectively in position and that the scaffold is in a stable condition.
- Check the ground conditions around the scaffold to ensure they are still suitable for safe dismantling operations.
- Suitable warning notices must be placed for public protection.
- Work completion certification and other required documentation that approve dismantling.

11.2.5. During-Dismantling Inspection

- Where a building or structure is being demolished the scaffold should be dismantled to ensure that no more than 4.0m remains standing above the last vertical tie points at any time.
- Care should be taken to avoid mishandling of materials, all of which should be lowered regularly and not "bombed" during the dismantle.
- Small amounts of material may be temporarily placed on lower lifts for convenience during dismantling, but care should be taken not to allow this material to build up to an unacceptable load.

11.3. Certification and Tagging System after Erection

After the Scaffold has been fully erected, inspected and passed for use by the competent person; and duly fixed with Green Tag declaring fit for use, it is necessary to keep it in fit condition. Regular Scaffold inspections must be carried out by a certificated scaffolder of the appropriate class, or a competent person such as a registered engineer, or a person who has sufficient training and experience to determine that the scaffold complies.

11.3.1. Scaffolding Inspection Checklist

S.N	Items to be Inspected	Yes	No	Action/ Comment
1.	Has the scaffold been inspected within the last 7 days and the scaffold register completed to include any changes to the scaffold?			
2.	Is the surrounding area and the vicinity of the bases for the scaffold water-logged?			
3.	Are the scaffold components and fittings showing no signs of deterioration by rusting?			
4.	Are the sole plates and base plates still in good condition and in its original position?			
5.	Are the standards or frames plumbs, as Observed from base level?			
6.	Are the ledgers and transoms horizontal as above?			
7.	Are all bracing completed?			
8.	Are the tie-ins to the structure correctly installed and in sufficient number and correct position to ensure the stability of the scaffold?			

9.	Are all fittings tidy and undamaged?			
10.	Are there any excavations or new constructions, which may affect the stability of the scaffold?			
11.	Are precautions being taken to prevent accidental damage to the scaffold by traffic or other causes?			
12.	Is the ladder access easy to climb?			
13.	Are ladders giving access to working platforms securely fixed at top and bottom, completely decked out and toe-boards fitted?			
14.	Are all working platform completely decked out and toe-boards fitted?			
15.	Are guardrails fitted at correct height and location?			
16.	Are the working platforms, access ways and landing cleared off any Obstructions, loose object and tripping hazards?			
17.	Do the working platforms feel “SOLID” to walk-on?			
18.	Are materials, stored on the platform, dispersed so as not to cause a concentration of load in excess of that permitted?			
19.	Has the scaffold been used only for its intended purpose? E.g. it has not been Used to support formwork, shoring or as a stabilizer for another scaffold?			
20.	Are you satisfied that the scaffold is safe for its intended purpose?			

11.3.2. Tagging System

For any type of Scaffolding - No tag no access that means that the scaffolding cannot be used, because nothing is certainly known about the subject scaffold. Unknown use may result in any sort of accidents or material damage.

- Scaffold tags are used to safely control how and when scaffolds are used
- Scaffold tag indicates type of scaffold and precautions to follow while on scaffold
    - **Green:** All components present, scaffolding fully erected and is ready for use- for the class of duty mentioned on the tag, e.g.-light duty, medium duty etc.

    - **Red:** Unsafe; do not use. Red sign indicates that something is defective, and the scaffolding has been declared as “NOT FOR USE”
    - **Yellow:** Incomplete and should not be used.

11.4. Case Studies

Case Study No: 01-Throwing Scaffold Components to height location from ground.

Description:

A scaffold gang was engaged in scaffold erection at 6m height. A workman was standing on ground and giving scaffold clamps to the workman who was standing on 6m height adopting wrong method, throw and catch.

During the process workmen who was standing on ground threw a clamp to the workman who was standing on 6m height on scaffold pipe. The workmen at 6m height failed to catch the clamp, which

down fell on workman's fore head who had thrown the clamps from ground . The person on the ground was badly injured. He was immediately taken to the hospital for medical care.

What went wrong?

- Scaffold materials were not being shifted to higher location by safe method (Gin wheel arrangement).
- Wrong activities details not discussed in TBT.
- Supervision not ensured during the process and unsafe practices allowed during erection of the scaffold.

Precautionary Measures:

- Gin wheel arrangement should be made available for shifting scaffold materials to higher elevation.
- Possibility of unfair things need to be discussed amongst the workmen for their awareness and alertness.
- Strict supervision needs to be ensured to avoid unsafe practices by the workmen.

Case Study 02: Collapse of mobile Scaffolds

Description of Accident:

A worker was assigned for painting job at roof of a building. He was erecting a mobile scaffold along a corridor of 12-meter height, while erecting, the scaffold toppled and the worker fell from the scaffold onto the ground 12m below.

What went wrong:

The mobile scaffold was not in a stable position and was not secured to the building structure at the time of accident.

When the worker climbed onto the mobile scaffold to tie the metal decking, the mobile scaffold toppled and the worker fell off from the scaffold.

Immediate cause(s)

- Improper position for task
- Inadequate or improper protective equipment
- Failure to secure scaffold

Root cause(s)

- Lack of experience
- Lack of skill
- Inadequate work standards
- Inadequate Hazard analysis and Risk assessment

Precautionary Measures:

- Risk assessment to be conducted prior to the job commencement.
- Use an alternative method of work, or institute safe work procedures for such work.
- Ensure proper safety measures are in place such as securing of mobile scaffold to the building structure and provision of lifelines for the workers.

11.5. Summary & Review Questions

- When shall the scaffold components be inspected?
- When should be the Scaffolding Inspected?
- Write at least 10 check points to be noted while inspecting and certifying a scaffolding?
- Can cross bracing can be used to climb onto scaffolding.

12. Chapter 5: Standard Practice of Scaffold Erection, Dismantle, Inspection & Maintanence

12.1. General Safety during Scaffolding work

Safety requirement during Erections:

Scaffolding should be erected so that the risks to the scaffolders, other workers and the public are eliminated or minimized.

12.1.1. Safety of Scaffolders

- The major life-threatening hazards facing scaffolders are the risk of falls from a height, falling scaffold components and the risk of contact with overhead electric lines.
- The scaffolding contractor should carry out a risk assessment relating to the type of scaffolding operations to be carried out at the site. The safety statement of the scaffold erection contractor and, where appropriate, the site safety and health plan should identify the hazards that erecting a scaffold on the site is likely to present and specify the necessary precautions.
- The BOCW Regulations, require persons at work to be protected from the danger of falling, either by the provision and use of collective safeguards such as adequate working platforms and guard-rails or, where this is not practicable, by the provision and use of safety nets or personal protective equipment, such as suitable safety harnesses and anchorages.
- Collective safeguards should be specified in the safety statement and/or safety and health plan. These will normally include, as far as is possible, the use of ladders or stairs and the placing of decking and guard-rails on each platform before scaffolders go onto it or else as soon as practicable.

- Where scaffolders will be working on a standard width scaffold for only a very short time, they may work off a three-board wide platform provided that guard-rails are installed immediately following the installation of the boards.
- Where the necessary collective safeguards will be inadequate during certain phases of the work, personal protective equipment, for example, nets harnesses and safety lines, should be used to supplement the collective safeguards.

12.1.2. Safety of Other Workers and Persons

- Other workers or members of the public may be placed at risk during the erection of scaffolding. Adequate precautions should be taken to eliminate or reduce the risk and these should include:
- Other workers and the public should be effectively excluded from the work areas by signs and/or barriers.
- Where persons cannot be excluded from the working area they should be protected by the provision of properly constructed sheeting or fans.

12.1.3. Incomplete Scaffolding

- A scaffold should be constructed so that it is left complete and is properly tied, braced and decked and has adequate guard-rails and toe boards.
- Where a scaffold is left incomplete there is a danger that it will be used to gain access while it is in a dangerous condition.
- Where a scaffold is partly erected, a prominent warning notice should be placed at each potential access point and barriers should be placed to prevent access.

Incomplete scaffolds should be completed as soon as practicable.

12.1.4. Ergonomical Aspects of Manual Handling

Ergonomic aspects entail the scientific approach to making work human. It is a technique that brings together the application of the human biological sciences in conjunction with the engineering sciences to achieve the optimum mutual adjustment of man with his work, the benefits being measured in terms of human efficiency and well-being.

Materials handling, whether doing manually or with mechanical equipment, can be a major source of occupational injuries, if safe methods are not adopted.

Manual Handling Methods:

Manual handling of materials accounts for an estimated 25 percent of all occupational injuries. There injuries are caused by

- Hazardous ingredients
- improper lifting
- carrying too heavy a load
- incorrect gripping
- failing to observe proper foot or head clearances
- failing to use or wear proper safety equipment
- poor job design

Large nos. of injuries occur to the fingers and hands during Manual Material Handling (MMH). Workers need to be taught by the concerned supervisors how to pick up and put down heavy, bulky, or long objects.

Some general precautions are:

- Inspect materials for slivers, jagged edges, burrs, rough or slippery surfaces
- Get a firm grip on the object.
- Keep fingers away from pinch points, especially when putting materials down.
- When handling lumber, pipes, or other long objects, keep hands

away from the ends to prevent them from being pinched.

- Wipe off greasy, wet, slippery, or dirty objects before trying to handle them.
- Keeps hands free of oil and grease.

Lifting and carrying:

The basic rules and instructions to be followed for manual lifting include:

- Never let workers overexert themselves when lifting. If the load is thought to be more than one person can handle, assign another person to the job.
- Lift gradually, without jerking, to minimize the effects of acceleration.
- Keep the load to the body.
- Lift without twisting the body.
- Follow the safe lifting procedures.

Safe lifting practices:

There are no comprehensive and sure rules for "safe" Lifting. Manual materials handling is a very complex combination of moving body segments, changing joint angles, tightening muscles, and loading the spinal- cord.

12.2. Step by Step Assembly instructions for Tube & Coupler Scaffolds

Step-01	Step-02

	
Step-03	**Step-04**
	
Step-05	**Step-06**
	
Step-07	**Step-08**

	
Step-09	**Step-10**
	
Step-11	**Step-12**
	

12.3. Step by Step Assembly instructions for Cuplock System Scaffolds

Step-01	Step-02
	
Step-03	**Step-04**
	
Step-05	**Step-06**
	
Step-07	**Step-08**

	
Step-09	**Step-10**
	
Step-11	**Step-12**
	
Step-13	

12.4. Job Hazard Analysis – Scaffolding

Scaffolding is a temporary structure used to support a work crew and materials to aid in the construction, maintenance and repair of buildings, bridges and all other manmade structures. There are four main types of scaffolding used worldwide today. These are Tube and Coupler (fitting) components, prefabricated modular system scaffold components, H-frame / facade modular system scaffolds, and timber scaffolds.

The following list shows hazards that have been identified and the controls that need to be implemented in order to provide a safer working environment for scaffolders. This list is not intended to be comprehensive and new hazardous situations will arise that will require new initiatives and controls. This is therefore a reference guide only

When assessing hazards associated with scaffolding these can be categorized in one or more of the following areas:

- Hazards associated with the loading/unloading /transportation of the scaffolding materials.
- Hazards associated with the storage of the scaffolding materials.
- Hazards associated with the design of the scaffolding.
- Hazards associated with the erection/dismantling/alternation of the scaffolding.
- Hazards associated with the environment in which the scaffolding is situated.
- Hazards associated with the use of the scaffolding.

Activities (in steps)	Possible Hazards	Risk Score	Safety Control	Responsible Person
Break the activity into steps. Each step should accomplish some major task and be in a logical sequence.	Identify the potential hazard associated with each step. Examine each to find possibilities that could lead to an accident.	Risk potential class 1,2 or 3	Specify what action or procedure will be taken to eliminate or minimize the risk of injury or damage, Include what measures will	Supervisor & Scaffolders

Activities (in steps)	Possible Hazards	Risk Score	Safety Control	Responsible Person
			be taken to ensure that the safety control is maintained.	
Unloading of scaffold materials.	Injuries like cut, fall, slip and strain, sprain of body due to handling/ arranging / lifting/shifting of scaffold components.	3	Provide adequate manpower for loading /unloading. Provide required tools, tackles and lifting equipment. Use hosting facilities by crane or hydra etc. Prepare small size of bundle of each items for safe lifting. Adequate supervision is must.	Supervisor & Scaffolders
Storage / stacking of scaffold materials in storage yard.	Injuries like cut, fall, slip and strain, sprain of body due to handling scaffold components.	3	Adequate manpower to be made available. Required PPE like shoes, Helmet, Hand gloves to be worn. Training on ergonomics and materials handing to be given.	Store in charger, Scaffolders

Activities (in steps)	Possible Hazards	Risk Score	Safety Control	Responsible Person
Inspection and color-coding of scaffolding component.	Injury due to falls over, striking of component like standards, ledgers, bracing, frames, planks, etc.	3	Trained and experienced painters to carry out color coding. A trained supervisor and scaffolders to carry out scaffold components inspection.	Inspector & Supervisor, Scaffolders
Loading/unloading of scaffold materials in truck, & transportation.	Injuries like cut, fall, slip and strain, sprain of body due to handling of scaffold components.	3	Provide adequate manpower for loading /unloading. Provide required tools, tackles and lifting equipment. Use hosting facilities by crane or hydra etc. Adequate supervision is must.	Supervisor & scaffolders
Scaffold execution preparedness, shifting of materials, & obtaining the work permit	Six directional hazards like toxic gas emission, leakage of chemicals, structure fouling, hot pipeline etc.		Work permit to be obtained. Skilled, experienced and competent manpower to carry out the risk assessment. Adequate	Responsible person, Supervisor & scaffolders

Activities (in steps)	Possible Hazards	Risk Score	Safety Control	Responsible Person
			consultation with relevant operation employees.	
Step by step erection of Scaffold component like sole board, base plates, standards, ledgers & bracings, planks, toe boards, ladders etc. Erection of Scaffold working platform Erection of edge protection, ladder and toe boards	Injuries like cut, fall, slip and strain, sprain of body, Injury on body or body parts & head due to falling of unsupported or loose scaffold component. Fall of materials or components from working platform. Electric shock or electrocution due to Live electricity wire is too close to scaffold erection.	3	Skilled and experienced manpower to complete the required tasks correctly. Competent person to supervise execution of scaffold erection. Qualified scaffolders to be used to erect the scaffold. Follow the procedure of erection of scaffold. Scaffold to be maintained in stable condition. Scaffold components must not be loaded beyond the design load limits. Components of different scaffold system not to	Supervisor, scaffolders Supervisor, scaffolders

Activities (in steps)	Possible Hazards	Risk Score	Safety Control	Responsible Person
			be mixed together. Scaffold components must be minimum 3.0 meters away from live electric wire. In case distance of 3.0 meters is not possible, isolate power of electric supply	
Inspection and Certification of scaffold	Injuries like striking the object to body, strains, and body pains due to fall from height while climbing on to platform. Fall from height due to gap in platform not having adequate planks for platform.	3	Scaffold to be firmly secured. Required no. of braces are to be installed. Ties are to be provided as per requirement of scaffold design. Ladder is secured firmly. Ensure required size and quantities of planks are installed for platform. Ensure all planks are firmly secured with suitable clamps.	Inspector, Supervisor, scaffolders

Activities (in steps)	Possible Hazards	Risk Score	Safety Control	Responsible Person
			Scaffold to be inspected by competent person prior to use.	
Use of scaffold	Fall injury due to scaffold collapse, due to vehicle or mobile plant/unit strikes erected scaffold. Fall from scaffold or working platform due to incomplete scaffold. / Removal of any no. of planks.	2	Barricading of area of scaffold to be carried out to protect unauthorized manpower movement. Scaffold need not to be erected too close to plant operating area. Live load on platform should not increase than design load duty. Ensure unauthorized removal of scaffold components. Scaffold to be inspected by competent person. Barricading and sign boards to be for provided for incomplete scaffold.	Supervisor, scaffolders

Activities (in steps)	Possible Hazards	Risk Score	Safety Control	Responsible Person
Alteration/ modification of scaffold	Injury due to scaffold collapse while scaffold becomes unstable, unsecured tools and equipment lying on working platform while alternation. Scaffold collapse or fall of a person from scaffold due to inappropriate alterations to scaffold	2	Scaffold design needs to be reviewed. Load bearing member need not be removed. Provide additional structural support as per the need for stability of scaffold design. Reposition the ties as per requirement of scaffold design. Ladder is secured firmly. Competent, skilled and trained person to be used for scaffold alteration. Qualified scaffolders to be used for complex alterations.	Competent person, Supervisor, scaffolders
Dismantling of scaffold	Fall from scaffold due to Scaffold incomplete or partly dismantled. Injury due to collapse of scaffold	2	Scaffold dismantling to be started from top. Remove the last erected component first and	Competent person, Supervisor, scaffolders

Activities (in steps)	Possible Hazards	Risk Score	Safety Control	Responsible Person
	components being unstable or incorrect while dismantling of scaffold.		follow the reverse while removal. No unauthorized removal of or interference with scaffold components. Ties and braces need to be removed in advance. Isolate incomplete scaffold by barricading. Skilled and trained scaffolders to carry out dismantling.	
Scaffold materials inspection after dismantling	Injury due to broken, bend and sharp edge components removed from scaffold. Injury due to toxic chemicals or gaseous effect on scaffold components.		Adequate manpower to be made available. Required PPE like shoes, Helmet, Hand gloves to be worn. Training on ergonomics to be given. Damage and broken components are to be separated.	Supervisor, scaffolders

12.5. Scaffolding Standards

- BS EN 12811 and BS EN 12810 – TG 20:13- Technical Guidance on the use of BS EN12811-1 and other European & British Standards.
- OSHA : 29 CFR Part 1926: Safety Standards for Scaffolds Used in the Construction Industry
- 29 CFR 1910.28 Safety Requirements for Scaffolding
- 29 CFR 1910.29 Manually Propelled Mobile Ladder Stands and Scaffolds (Towers)
- 29 CFR 1926.451 General Requirements (Scaffolds)
- ANSI/ASSE A10.8-2001, Scaffolding Safety Requirements
- **IS 2750 :** Steel Scaffoldings
- **IS 3696 :** Safety code of scaffolds and ladders: Part 1 Scaffolds
- **IS 3696 :** Scaffolds and Ladders - Code of Safety - Part 2 : Ladders
- **IS 4014 :** Part 1 Code of practice for steel tubular scaffolding Part 1 Definitions and materials
- **IS 4014 :** Part 2 Code of Practice for Steel Tubular Scaffolding - Part II : Safety Regulations for Scaffolding

BS: British Standard (US)

EN: European Standard (Europe)

IS: India

OSHA: Occupational Safety and Health Administration (US)

ANSI/ASSE: American National Standard/American Society of Safety Engineers (America)

NASC: National Access & Scaffolding Confederation (UK)

12.6. Statutory & Legislative Requirement:

BOCW Central Rules,1998 –Part-III : Chapter XIX (Rules no.188 – 205)
CHAPTER - XIX / Rule-188

The employer shall ensure at a construction site of a building or other construction work that-

- Every scaffold and every component thereof is of adequate construction, made of sound material and free from defects and is safe for the purposes for which it is intended for use;
- All metal scaffolds used in building or other construction work conform to the relevant national standards.

CHAPTER - XIX / Rule-189

The employer shall ensure at a construction site of a building or other construction work that no scaffold is erected, added, altered or dismantled except under the supervision of a responsible person for such erection, addition, alteration or dismantling.

- **"Responsible Person"** means a person appointed by the employer to be responsible for the performance of specific duty or duties and who has sufficient knowledge and experience and the requisite authority for the proper performance of such duty or duties;
- **For Example:** Scaffold supervisor, Scaffold Engineer, Scaffold Erector/Dismantler

Minimum Clearances from Electrical Lines	
Insulated Lines	
Less than 300 volts	3 feet
300 volts to 50 KV	10 feet
More than 50 KV	10 feet plus 4" for each additional kv
Uninsulated Lines	
Up to 50 kv	10 feet
More than 50 kv	10 feet plus 4" for each additional kv

12.7. Case Studies

Case Study 01: Collapse of scaffolding at Water tank construction.

Description:

A total of 20 labourers were engaged in the construction work of two water tanks for sewage treatment plant with the capacity 100 million litres of effluents per day. For centring work at one of the tanks, the workers were engaged in erecting scaffolding. During erecting, the scaffolding crashed and collapsed where 3 workers died on the spot & 11 got injured & sent to nearby hospitals. Six workers escaped with minor injuries.

What went wrong:

The scaffolding contract job was given to an inexperienced contractor where he used substandard materials & components. It was not designed adequately & the correct methodology of erection was not followed properly.

The engaged workers were mostly unskilled & don't have basic knowledge of scaffolding.

Immediate cause(s)

- Improper method of erection sequence
- Use of substandard materials & components
- Failure to maintain Strength, Stability & Rigidity of the scaffold.
- Negligence of adequate design.

Root cause(s)

- Lack of experience & subject knowledge
- Lack of skilled manpower
- Lack of supervision & Inspection regarding the material quality & specification.
- Inadequate Hazard analysis and Risk assessment

Recommendations:

- Provide adequate training & knowledge to the workers.
- Engage competent/specialized scaffolding agency for performing the job.
- Risk assessment to be conducted prior to the job commencement.
- Adequate design should be done, verified & approved by competent person or structural engineer.
- Engage good quality of materials & components.
- Ensure proper method of erection sequence to be followed as per the guidelines.
- Periodic inspection by competent person should be done & to be certified.

Case Study 02: Collapse of Scaffolding due to hit by tractor

Description:

A large portion of scaffolding which was made for the process of attaching glass in a multi-storey building has collapsed after a tractor-trailer, used for loading and unloading materials, accidentally backed into the scaffolding. The entire section collapsed bringing the workers down with it and falling onto the tractor killing the driver. Four construction workers were killed and five injured after the accident that happened at a multi-storey building under-construction in Noida, India.

What went wrong:

- Hit by tractor-trailer while reversing.
- Scaffolding was not enough sturdy.
- Ties/ lateral supports were removed from the scaffolding causes the scaffolding unstable.
- Negligence & poor judgment of tractor-trailer driver.

Root cause(s)

- Lack of Supervision during the job.
- Lack of competent person for inspection & certification for its strength, stability & Rigidity.
- Inadequate Hazard analysis and Risk assessment.
- Inadequate work permit system.
- Lack of awareness regarding the job hazards.

Recommendations:

- Engage competent workforce especially the drivers, operators for performing the job.
- Risk assessment to be conducted prior to the job commencement.
- Provide adequate training & knowledge to the workers for enhancing their knowledge.
- Periodic inspection by competent person should be done & to be certified.
- Ties/ lateral supports should not be removed before dismantling.
- Work permit system should be followed at site during multiple agencies & simultaneous Operations (SIMOP) are carried.
- Adequate cordon off to be provided surrounding the scaffolding area.

12.8. Summary & Review Questions

- What is the minimum distance to be maintained between the live power lines (H.V included) and the closest part of the scaffold?
- Which type of mobile scaffold is lightweight with fast assembly and dismantling usually needing no special tools?
- Mention any two National and International standards each for scaffolding?
- What are the load classifications in scaffolding as per EN 12811 standard?

13. Reference

- *BS 1139 – Metal scaffolding*
- *BS 2482 – Specification for timber scaffold boards*
- *BS 5080 – Structural fixings in concrete and masonry*
- *BS 5507 – Methods of test for falsework equipment*
- *BS 5867 – 2 – Fabrics for curtains, drapes and window blinds*
- *BS 5975 – Code of Practice for temporary works procedures and the permissible stress design of falsework*
- *BS EN 39 – Loose steel tubes for tube and coupler scaffolds*
- *BS EN 74 – Couplers, spigot pins and baseplates for use in falsework and scaffolds*
- *BS EN 1004 – Mobile access and working towers made of prefabricated elements*
- *BS EN 1065 – Adjustable telescopic steel props*
- *BS EN 12810 – Façade scaffolds made of prefabricated components*
- *BS EN 12811 – Temporary works equipment*
- *Code of Practice for the Structural Use of Steel, 2011 (Buildings Department, Hong Kong)*
- *Code of Practice on Wind Effects in Hong Kong, 2004 (Buildings Department, Hong Kong)*
- *Guidance Notes on Classification and Use of Safety Belts and their Anchorage Systems (Labour Department, Hong Kong)*
- *A Guide to Practical Scaffolding 'The Construction and Use of Basic Access Scaffolds' (Construction Industry Training Board, South Australia)*
- *Singapore Standard CP 14 – Code of practice for scaffolds*