

SCAFFOLDING TRAINING (Intermediate Level)



The Aim & Objective

- The aim and objectives of offshore scaffolding training program are to equip the delegate with the basic knowledge, understanding and skills required to perform the role as scaffolder safely and effectively.

Course Learning Outcomes

Upon completion of the modules, the participant should be able to:

- Explain the legal requirements/legislation in scaffolding practices.
- Elaborate the safety system of scaffold works at work place
- Demonstrate the sequencing of erection/dismantle and sketch/drawing.
- Apply the working knowledge of scaffolding principles and methods of erection and dismantle basic scaffold.

Module 1

Scaffolding Overview

What is a scaffold?

A scaffold is a temporary structure which provides access to or from which persons work, or which is used to support materials, plant or equipment.



Scaffolding

High Risk Occupation



- ❑ Scaffolding has been, and continues to be, a high risk occupation. The number of death and serious injuries associated with scaffolding operations has been high.

Scaffolding

- ❑ The prime objective was to substantially improved safety standard to ensure that operatives engaged in the erection, alteration and dismantling of scaffolds were properly trained and given sufficient experience to carry out such work safely and properly, and to ensure that the structure is safe for use.



It must be correctly designed and constructed, so it is safe to use.

After completion it must be inspected by a competent and certified inspector



Scaff-Tag



Legislation Requirement

- ❑ The rules & regulations that cover the OSHA Act 514 and Code of Practice BS 5973.
 - The sequence of erection and dismantling.
 - The safety aspects of the scaffolding structure.
 - To name the scaffolding components
 - How to handle the scaffolding materials properly.
 - How to visually inspect the materials before use.

Legislation Requirement

- Metal parts used for scaffolds shall be of suitable quality and be in good condition and free from corrosion or other patent defect likely to affect their strength materially.

- All scaffolds and their supports shall be capable of supporting the load they are designed to carry with a safety factor of at least four.

Roles & Responsibilities of a Scaffolder

- To support the site maintenance/outage team and will be responsible for carrying out Scaffolding works in a safe, competent manner and in line with company safety rules & regulations.
- Ensure that risk assessments are carried out prior to the commencement of work.
- Ensure PTW system has been completed & approved by the relevant assigned signatories.
- To don appropriate PPEs at all time including full-bodied safety harness

Roles & Responsibilities of a Scaffolder

- ❑ It is the duty of a scaffolder to safeguard life of both himself and others working in the vicinity of the operation, or likely to enter the vicinity.
- ❑ To abide by laid down regulations under the relevant act and in the absence of regulations, use safe practices
- ❑ To observe scaffolding components, structures, ties, access and storage before alteration of any parts of scaffolding frames.



Roles & Responsibilities of a Scaffolder

- To maintain the scaffolding components to ensure they are serviceable and safe to use.
- To use the right equipment for the scaffold to be erected.
- Know the sequence of erection & dismantling.
- Comply to the rules and regulations of any scaffolding erection.
- To make sure that all equipment are serviceable before use.

Roles & Responsibilities of a Scaffolder

- ❑ it is their duty to prevent objects from falling.
- ❑ They must barricade the area where the scaffold is being erected and display a warning.



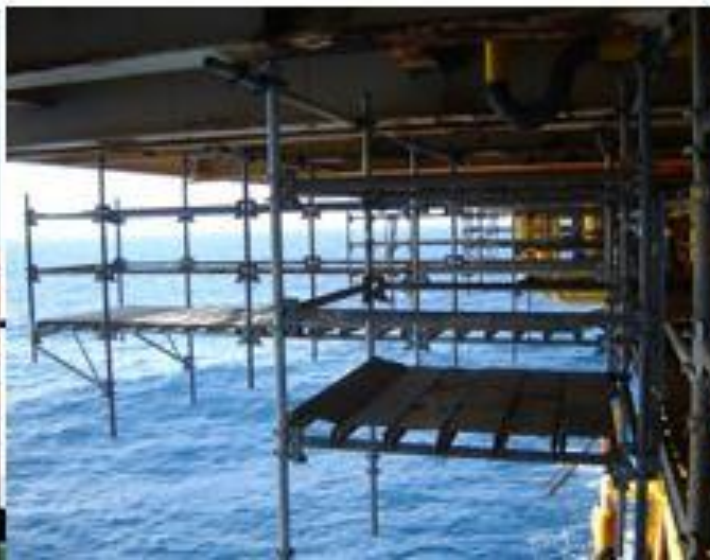
Purpose of Scaffolding

- Support
- Loading
- Access
- Protection
- Storage



Purpose of Scaffolding

- ❑ To allow workers access to various work areas - construction, maintenance works and site repair operations onboard installation.
- ❑ For activities like cleaning, painting, replacing worn components, and inspecting parts of the installation that cannot be reached from fixed walkways and platforms.
- ❑ To provides support for personnel and the equipment on a temporary basis for activities like construction and maintenance.



Personal Protective Equipment Requirement

- Full body Harness
- Hard hat
- Coverall
- Safety boots
- Safety glass
- Hand Gloves



Module 2

The Scaffolding Requirement

Scaffold Terminology

Scaffold Couplers and Fittings

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

Adjustable base plate – A metal base plate embodying a screw jack.



Scaffold Terminology

Scaffold Couplers and Fittings

Board-clip – A clip for fixing a board to a scaffold tube.

Toe-board clip – A clip used for attached toe boards and to the tubes.

End toe-board clip – A similar device to be use at the end of toe boards.



Scaffold Terminology

- ❑ **Coupler** – A component used to fix scaffold tubes together.
- ❑ **Check coupler or safety coupler** – A coupler added to a joint under load to give security to the couplers carrying the load.
- ❑ **Fired finial coupler** – A coupler torn a tube to place at the end of another at right angles at the same place of a handrail.
- ❑ **Parallel coupler** - A coupler used to join two tubes in parallel.
- ❑ **Purlin, rafter or ridge coupler** – Special angle or variable angle couplers for joining members in sheeted buildings and roof.

Scaffold Terminology

- ❑ **Right angle coupler** – A coupler used to join tubes at right angles.
- ❑ **Sleeve coupler** – An external coupler used to join one tube to another coaxially.
- ❑ **Supplementary coupler** – Couplers added to a joint to back up the main coupler taking the load when the estimated load on the joint is in excess of the safe working load of the main coupler.
- ❑ **Swivel coupler** – A coupler used for joining tubes at an angle other than a right angle.
- ❑ **Swivel finial coupler** – A coupler to fix a tube across the end of another in the same plane but an angle, as the handrail to a staircase.

Scaffold Terminology

Hop up bracket or extension bracket

– A bracket to attach usually to the inside of a scaffold to enable boards to be placed between the scaffold and the building.



Scaffold Terminology

Joint pin – An expanding fitting places in the bore of a tube to connect one tube to another coaxially.



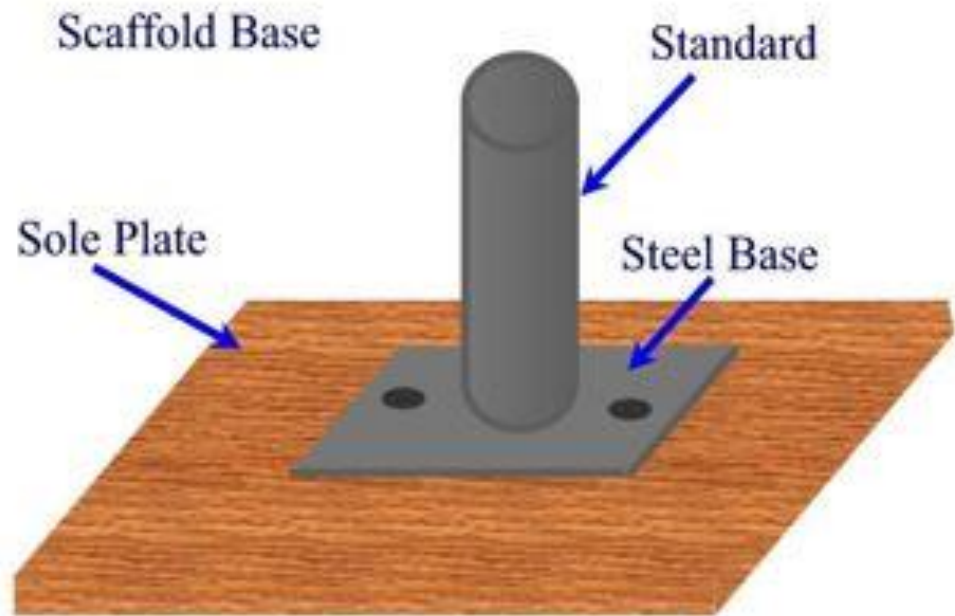
Reveal pin – A fitting used for tightening a reveal tube between two opposing surfaces.



Scaffold Terminology

Sole plate

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



Scaffold Terminology

Spigot – An internal fitting to join one tube to another coaxially.

Fixed spigot - A spigot permanently fixed to the end of a scaffold tube.

Scaffold Measurements

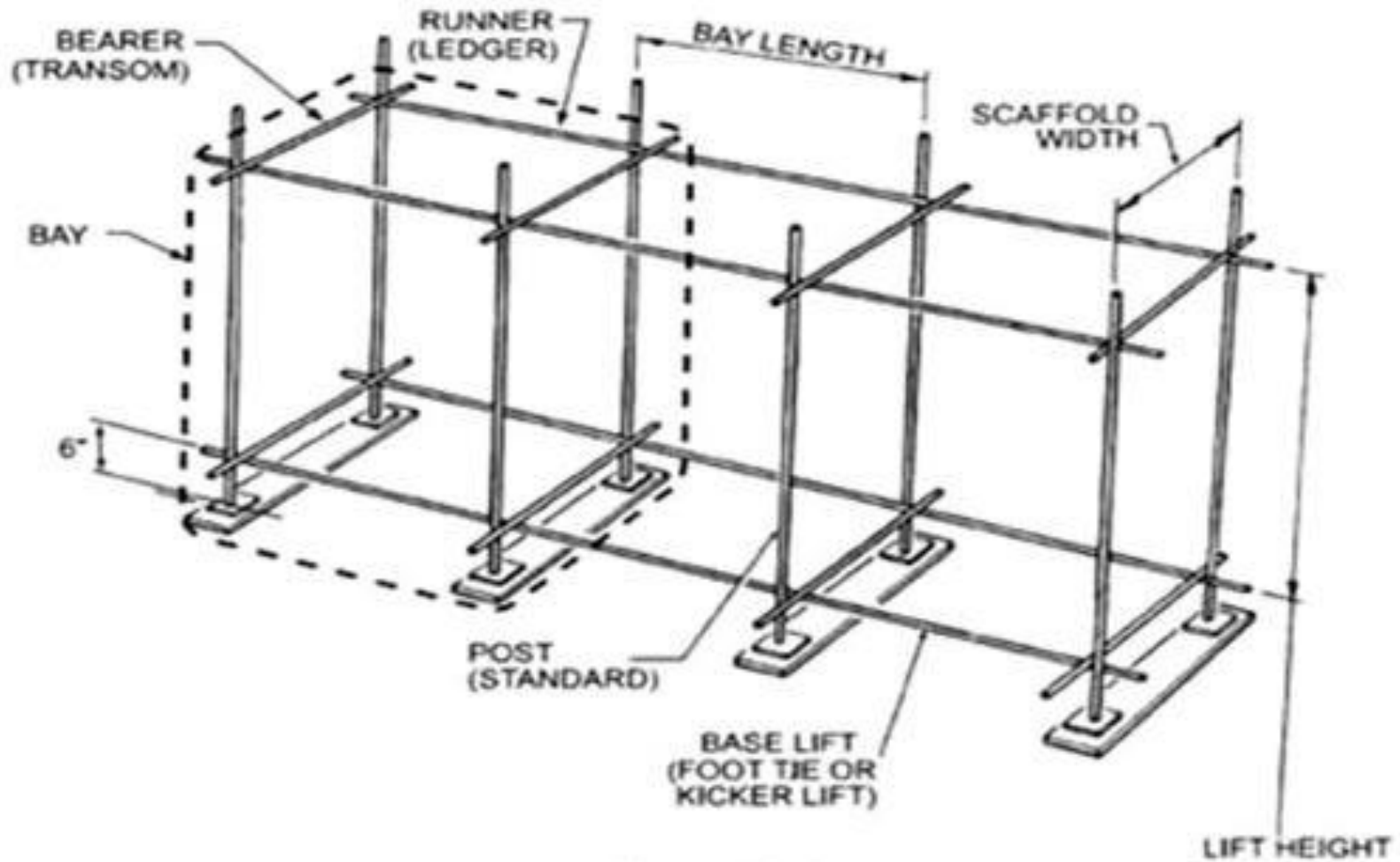


Figure II.9.6
SCAFFOLD MEASUREMENTS

Basic Scaffold Requirements

- Scaffolds must be erected with good materials, in good condition, free from excessive rust, corrosion etc.
- All scaffolding materials must be inspected by a competent person on every occasion before use.
- Scaffolds must be erected and dismantled only by a competent person.
- Scaffolds must be rigid and erected on sound foundations.
- Standards and ledgers must be securely fixed and braced.

Basic Scaffold Requirements

- Standards and ledgers must be securely fixed and braced.
- Transoms must be level and fixed, the spacing of the transoms must not be more than 1.50 m (5 ft). when using 38 mm. boards.
- No scaffold board may overhang its last support by more than 4 times the board thickness, nor by less than 50 mm.
- All scaffolds being erected or in the stage of dismantling must be labeled with suitable warning notices.

Scaffold Materials

Scaffold tubes

There are 3 main types of tubes in common use:

1. Black steel tubes
2. Galvanized steel tubes
3. Aluminium alloy tubes

Both black steel and galvanized steel tubes possess the following properties:

Outside diameter	48.3 mm.
Nominal wall thickness	4.0 mm.
Weight	4.4 kg/m.
All fittings weigh at least	1.0 kg.

Scaffold Materials

Scaffold tubes must be:

- Straight and true
- Free from cracks, splits, bad dents and excessive corrosion
- Cut square and clean at each end.



Scaffold Materials

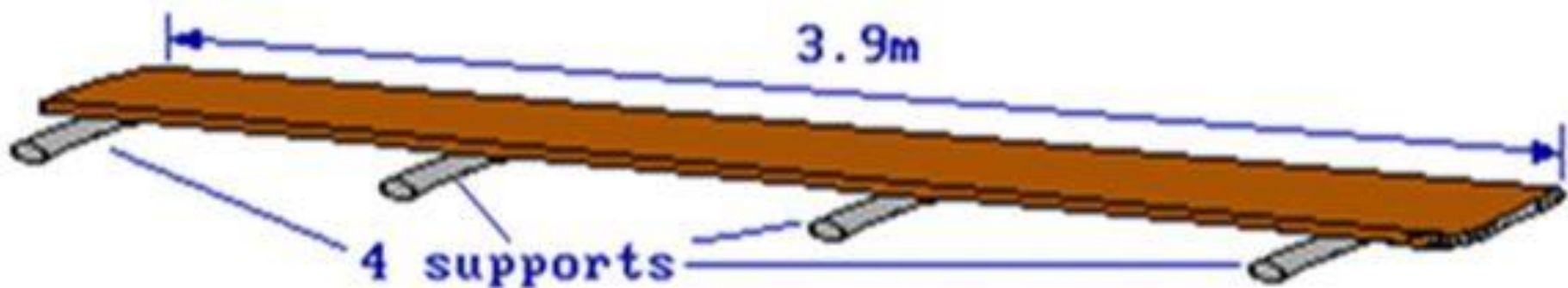
Scaffold boards:

All scaffold boards must be manufactured in accordance with the regulations

They should be supported as follows:

38 mm thickness, every 1.5 m

50 mm thickness, every 2.6 m



Scaffold Materials

Scaffold Fittings

Right Angle Couplers

Connect ledgers to standards

Min. S.W.L. of 635 kg

Known as doubles



Scaffold Materials

Scaffold Fittings

Swivel Couplers

Are used to connect any tubes that cross each other at an angle other than 90° normally used to connect braces to standards and occasionally to make parallel joints. Swivel couplers should **NEVER** be used as right-angle couplers.



Scaffold Materials

Scaffold Fittings

Putlog Couplers

They are used to connect transoms to ledgers, they are only suitable for light duty use.

Putlog couplers must be capable of passing the slip test as specified by the British Standards.



Scaffold Materials

Scaffold Fittings

Sleeve Coupler

Generally called sleeves, are also used to connect tubes end to end.

This fitting has a resistance to bending, at least equal to any tube. It has a Safe Working Tension of 315 kg.



Various Types of Couplers



Various Types of Couplers



Scaffold Materials

Scaffold Fittings

Joint Pins (Spigots)

The spigot is inserted into the ends of the tubes and the centre bolt tightened, causing the two parts to expand and grip the insides of the tubes.

The fittings **SHOULD NOT** be used in positions where they will be subject to bending or tension (pulling force).



Scaffold Materials

Scaffold Fittings

Base plates

They are used to distribute a load from a standard or raker, prevent lateral movement and prevent damage to the tube.



Scaffold Materials

Scaffold Fittings

Inspecting the fittings: (As per spec. B.S. 1139)

- Not corroded
- Lightly oiled
- Correct types used and in right position
- Only right angle couplers used for ties

Scaffold Tools & PPE



Scaffold Tools & PPE



Module 3

Scaffolding Erection & Dismantling Requirement

Various Types of Scaffolds

Modular system scaffold

- ❑ Standardized individual members providing a selection of levels at which prefabricated horizontal members may be attached to create a custom designed assembly.

Examples of modular systems:

- Cuplok system
- All round system (Layher)



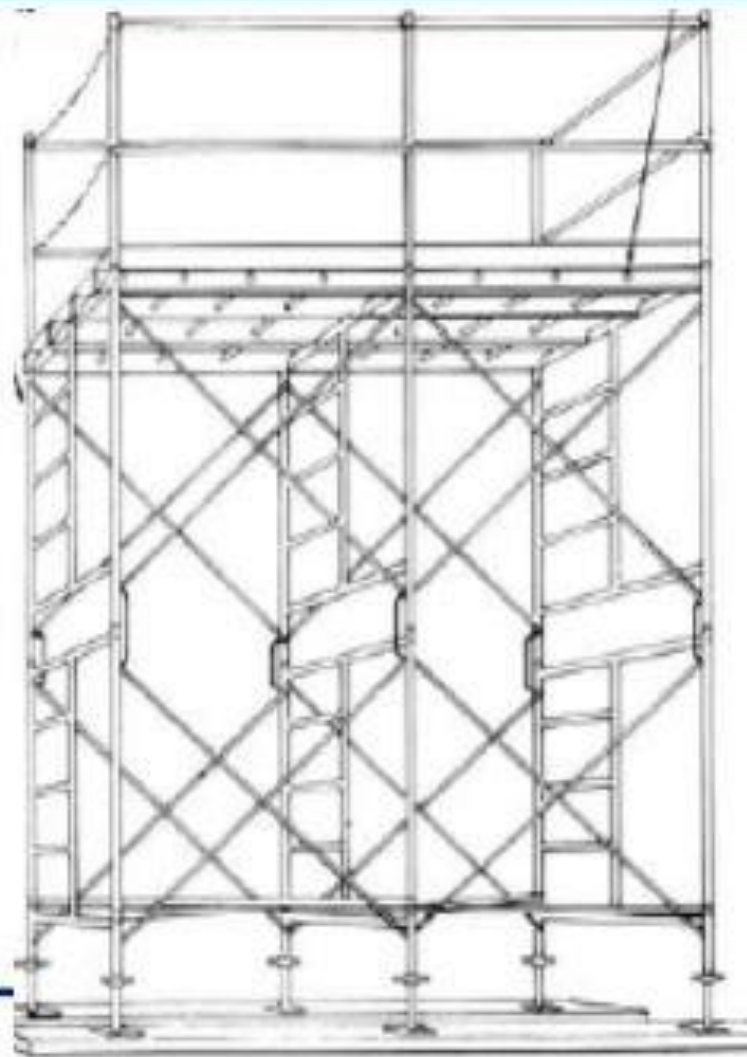
Various Types of Scaffolds

1. Free-Standing Scaffold

Free standing scaffold is not attached to any other structure and is stable against overturning on its own account, it's been assisted by guys or rakers and anchors.

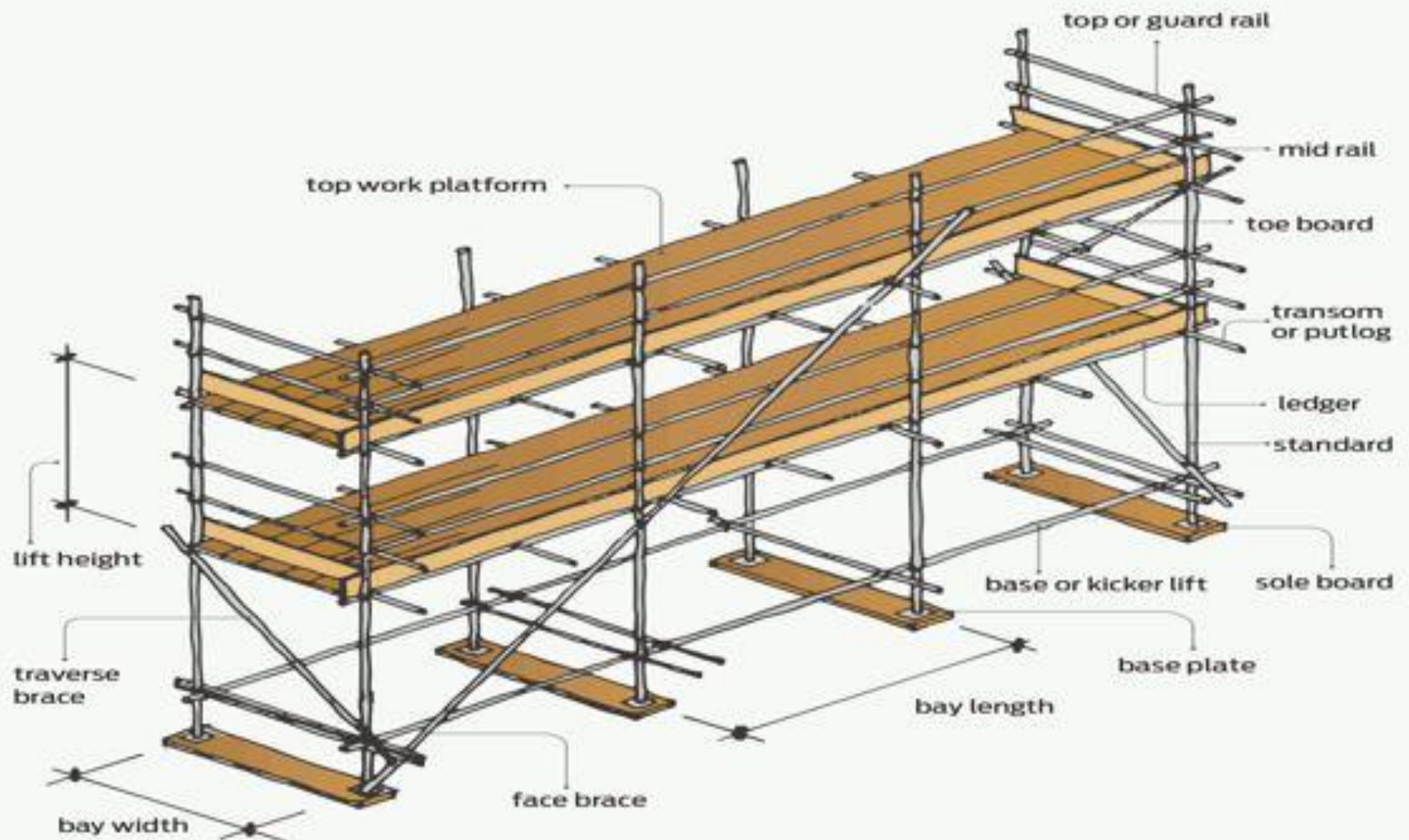
2. Independent Tied Scaffold

Independent tied scaffold means a scaffold, the work platform of which is supported from the base by 2 or more rows of standards and which apart from the necessary ties, stands completely free of the building.



Various Types of Scaffolds

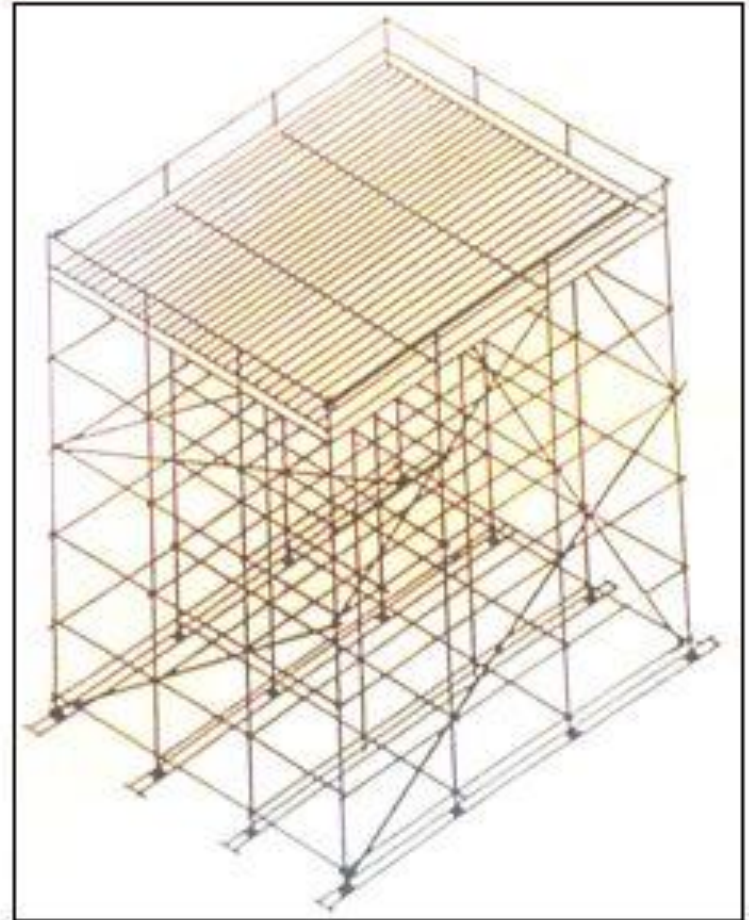
Independent Tied Scaffold



Various Types of Scaffolds

3. Birdcage Scaffold

A birdcage scaffold is an independent scaffold that consists more than two rows of standards in both directions and it is connected by ledgers and transoms. It is mainly used for work that is to be carried out on single level, such as ceiling.



Various Types of Scaffolds

4. Tower Scaffold

A scaffold with only one work platform at the upper most level and has only one bay on either side.

It can be either free-standing or tied to the building.



Various Types of Scaffolds

5. Rolling Scaffold (Mobile Scaffold)

A scaffold erected in the manner of a tower scaffold except that its height shall not exceed three times the least width at the base and it is fixed with castor wheel at each standard.



Various Types of Scaffolds

6. Suspended Scaffold

A scaffold suspended by means of ropes or chains and capable of being raised and lowered but does not include a boatswain's chair or similar appliance.

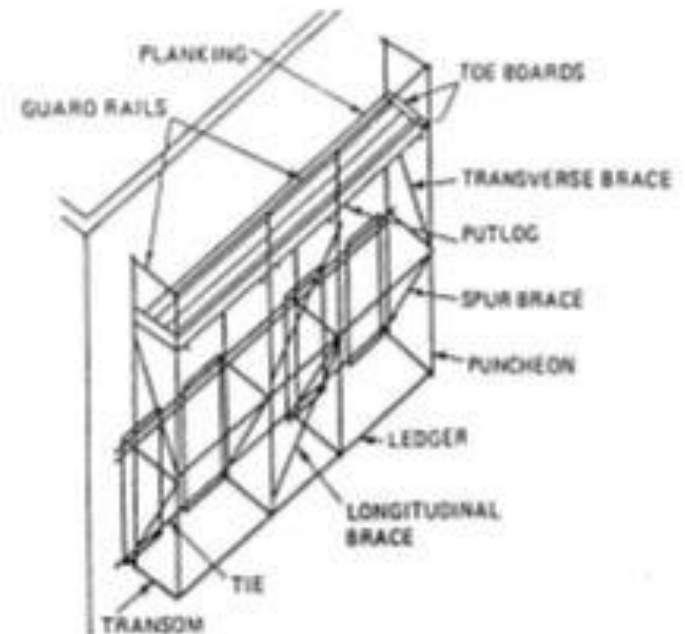


Various Types of Scaffolds

7. Truss-Out Scaffold

A supporting scaffold structure erected out and protruding through windows or similar openings on building where it may not be practical to erect from ground level. It is used for minor repairs to walls or for works on upper windows in a tall building.

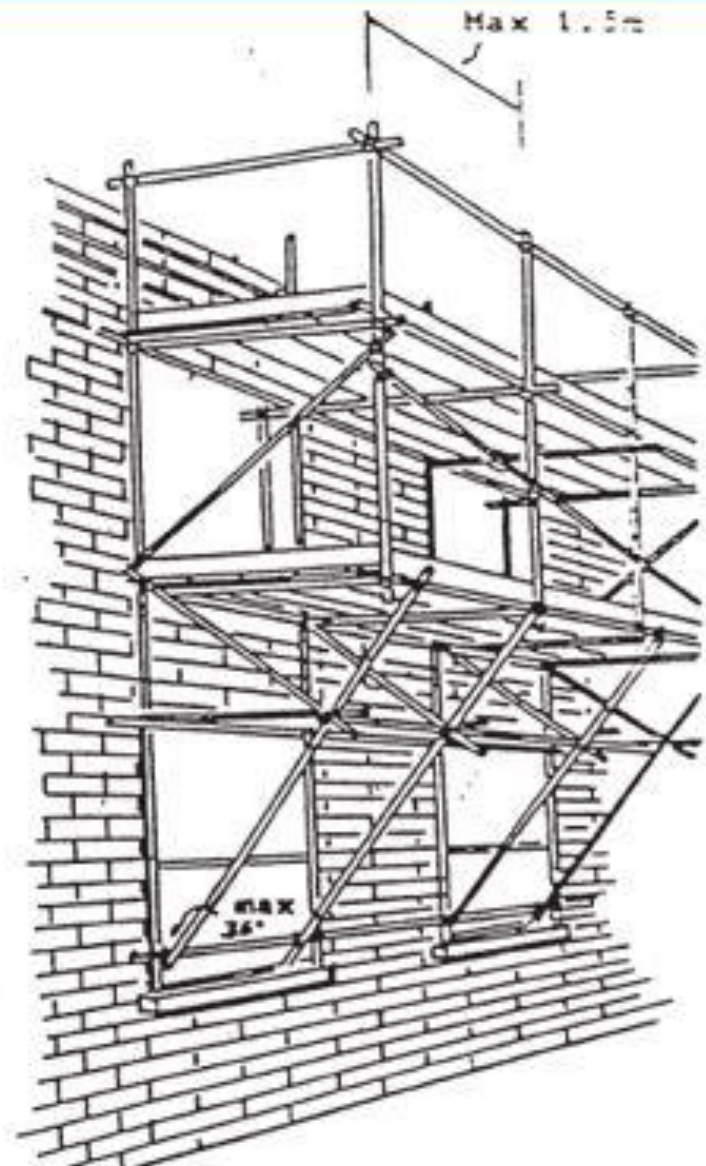
SPUR SCAFFOLD-BOX TYPE



Various Types of Scaffolds

Truss-Out Scaffold

- A truss-out scaffold is an independent tied scaffold, not erected from the ground but supported by a scaffolding structure projecting from the face of a building or structure.
- The supporting scaffolding structure is referred to as a truss-out.



Various Types of Scaffolds

8. Hanging (Slung) Scaffold

A scaffold suspended by means of lifting gear, ropes, chains or rigid members and not provided with means of raising and lowering by a lifting appliance or similar device.



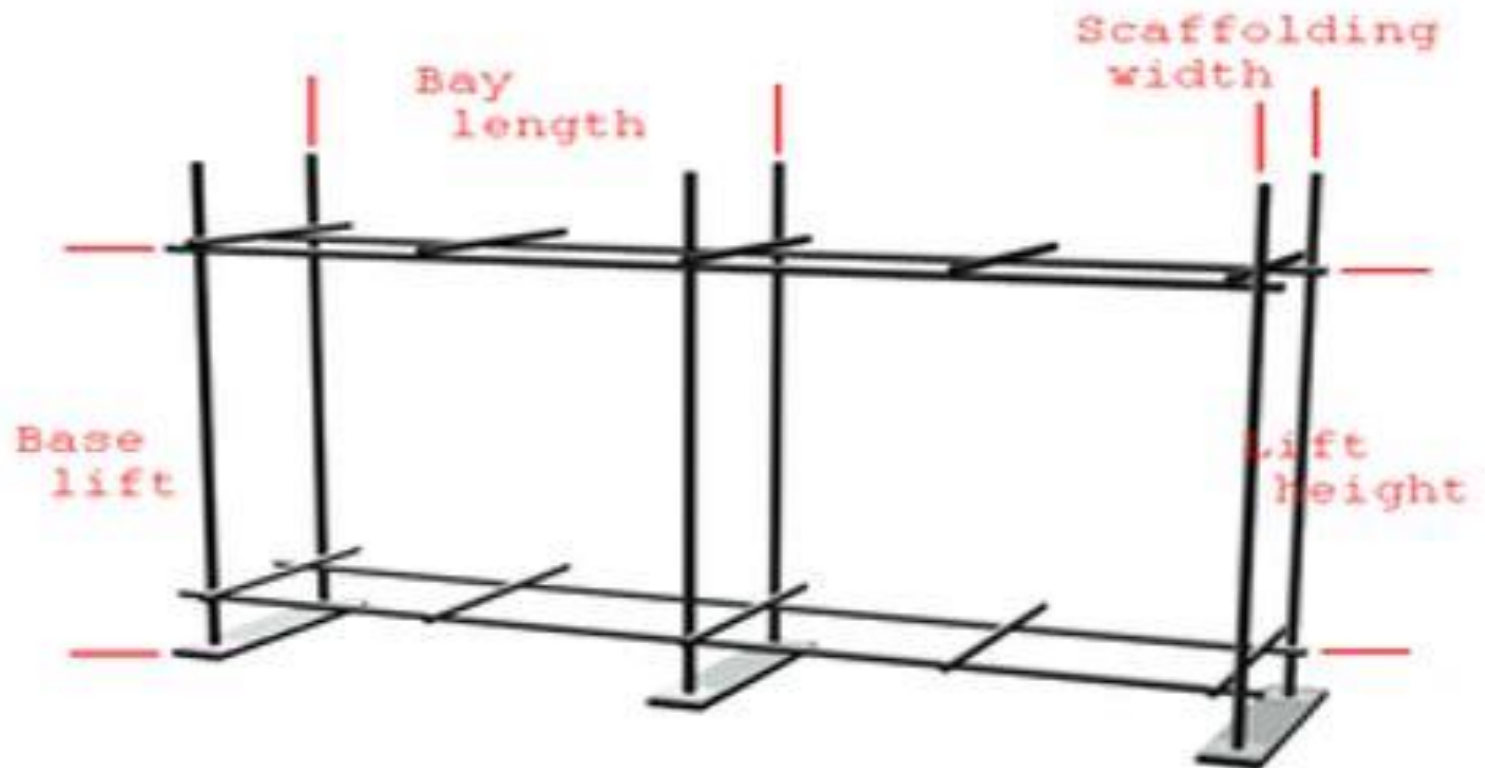
Various Types of Scaffolds

9. Cantilever With Drop Scaffold

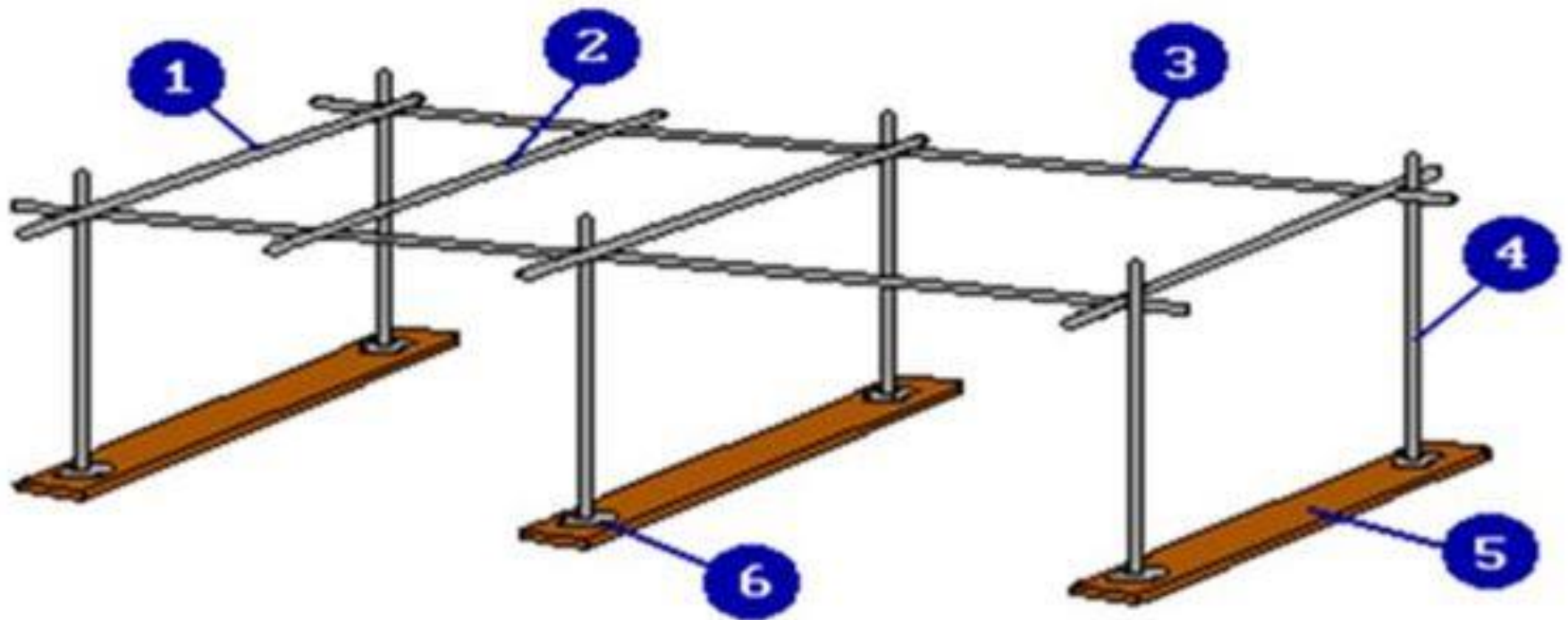
An independent tied scaffold erected on beams cantilever out from a building. It is used in cases where it is impracticable or desirable to found the scaffold on the ground.



Scaffold Components



Scaffold Components



1. Main transom
2. Intermediate transom
3. Ledger

4. Standard
5. Sole Board
6. Base Plate

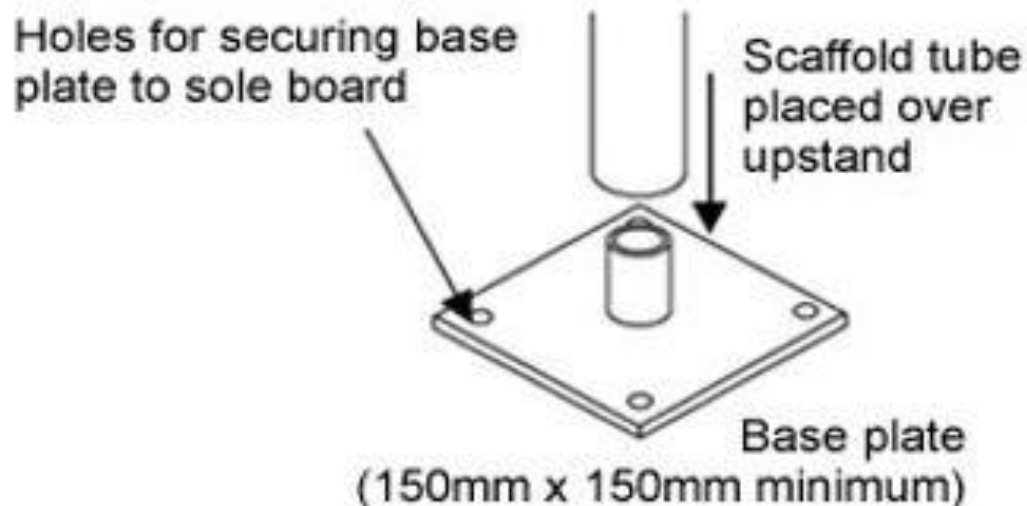
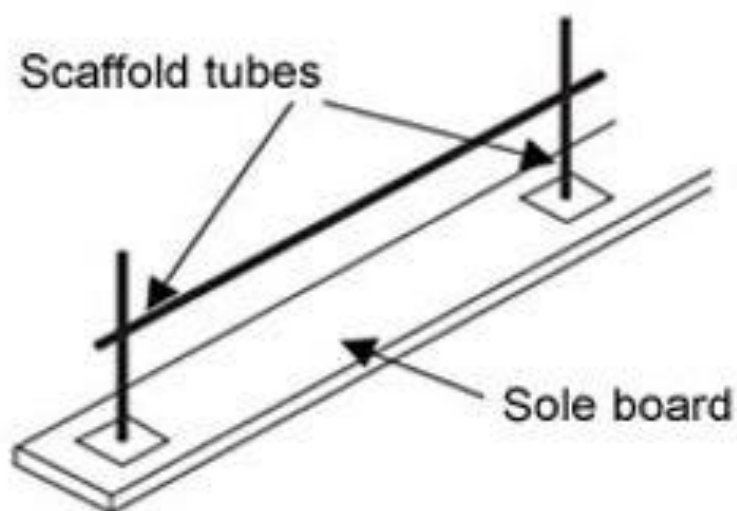
Scaffolding Foundation

- Any structure, whether it be a house or a multi-storey block of flats, must have a foundation capable of carrying the load safely for its entire life.
- This also applies for scaffolds
- The foot of standards must be on suitable base plates in order to prevent any slipping or sinking, otherwise their displacement must be prevented in some other way.
- The foundations of a scaffold should be adequate to carry and spread the load imposed, both locally at each standard and to carry the whole weight of the scaffold.
- The foundation for a scaffold must be maintained in a adequate condition during the life of the scaffold.

Scaffolding Foundation

Base plates:

On hard surfaces such as steel and concrete, where there is a sufficient hardness and thickness to prevent the scaffold tube penetrating into the surface, the standards of a scaffold may be placed directly on the surface, although it is recommended that base plates should always be used.



Scaffolding Foundation

- ❑ If the sole board is of timber on soft ground, it may be necessary for this to be more than 30 cm thick.
- ❑ Heavy duty scaffolds and poor ground will require stronger foundations.



The minimum sole board requirements are:

Firm ground – 500 mm long x 225 mm x 35 mm

Soft ground – 765 mm long x 225 mm x 35 mm

Under 2 standards – 1550 mm long x 225 mm x 35 mm

Scaffolding Foundation

Basic rules for foundations:

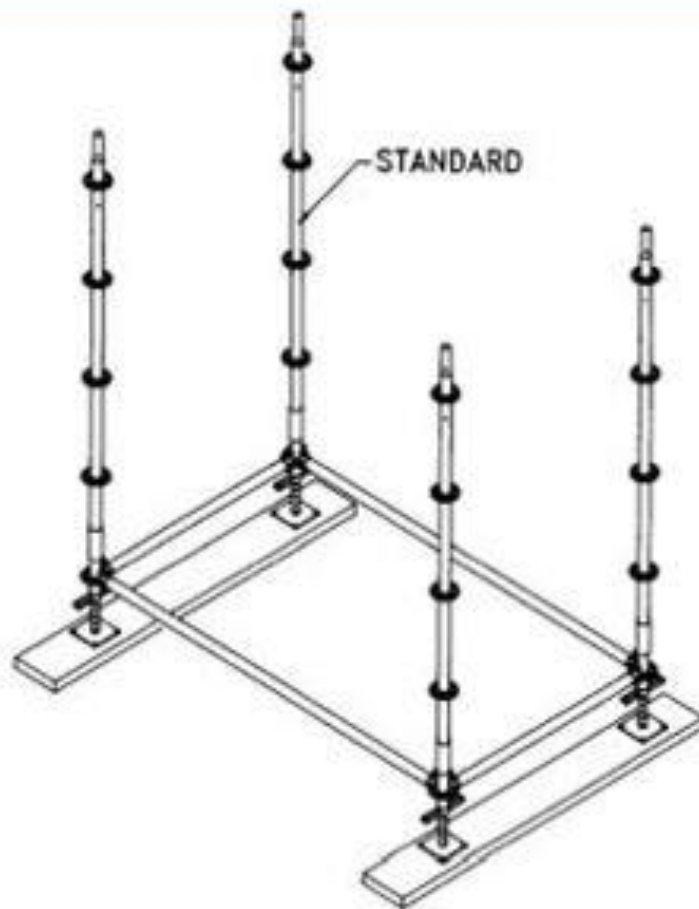
- The ground must be capable of supporting the scaffold.
- The sole boards must be capable of spreading the weight of the structure without distortion.
- Two standards per sole boards are better than one.
- Sole boards placed at right angles to the building should not project too far beyond the face of the scaffold.
- Sole boards should not be undermined.

Standards

Standards are the main vertical element of the scaffold framework and carry the weight of the structure and its load.

Standards MUST be vertical.

The spacing of standards is determined by the intended use of the scaffold, the distance between standards being reduced as the expected load increases.



Standards

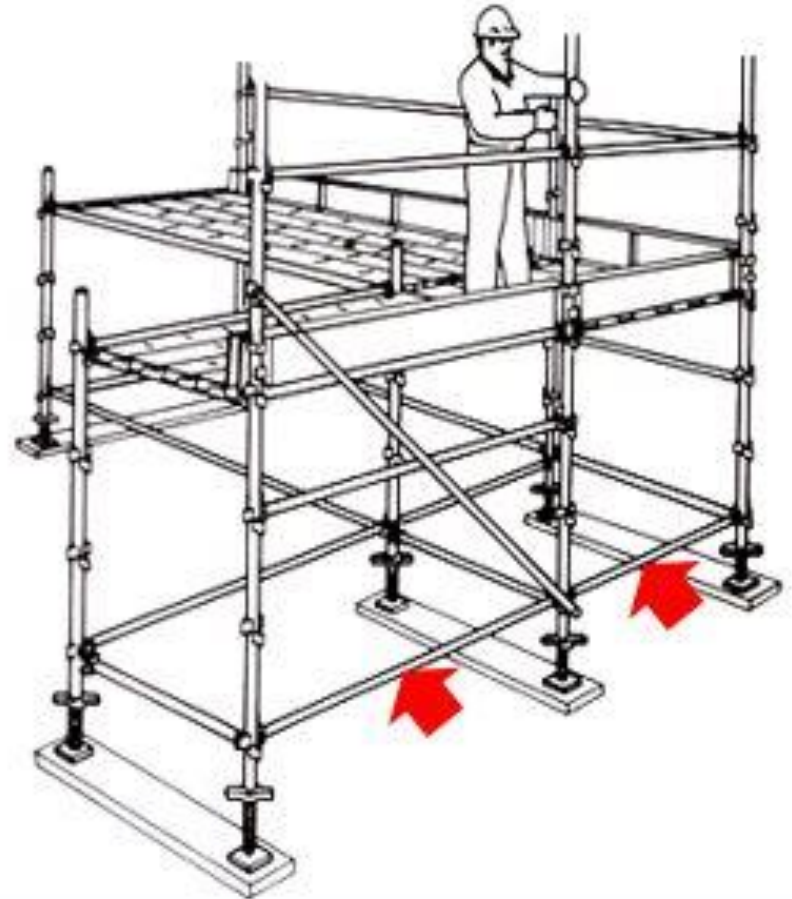
The Requirements:

- Upright/plumb
- Correctly spaced
- Joints staggered
- In good condition



Ledgers

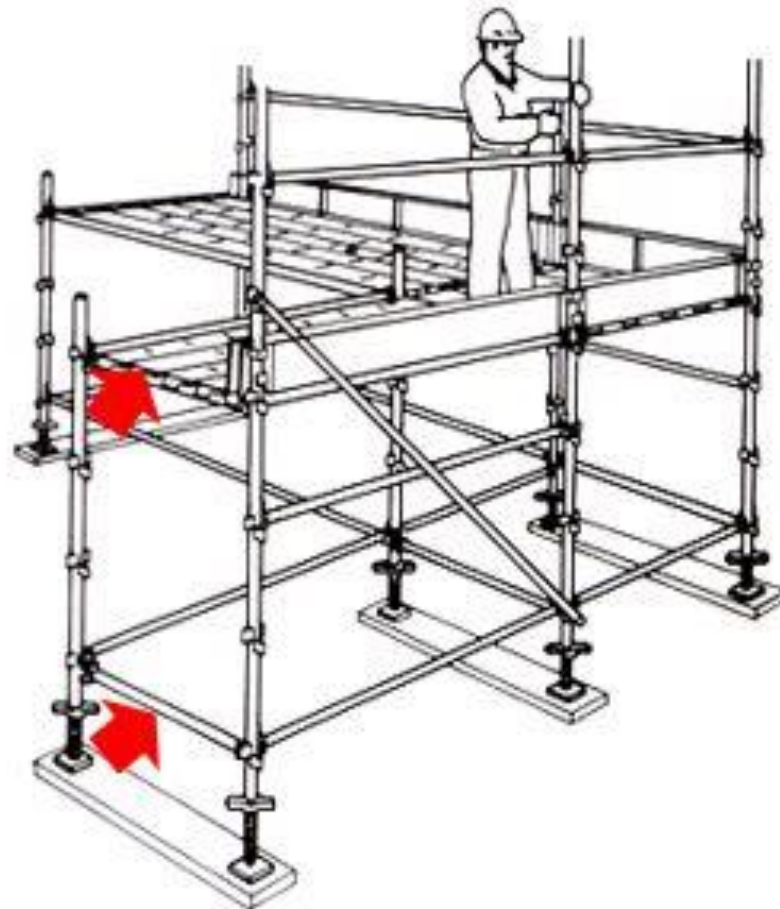
- ❑ Ledgers are the main horizontal tubes and provide lateral support to the structure.
- ❑ They must be level and fixed to the inside of standards with right-angle, load bearing couplers.
- ❑ Ledgers should be joint with sleeve couplers and should be as close to the node points (the point at which the ledger is fixed to the standard) as possible.



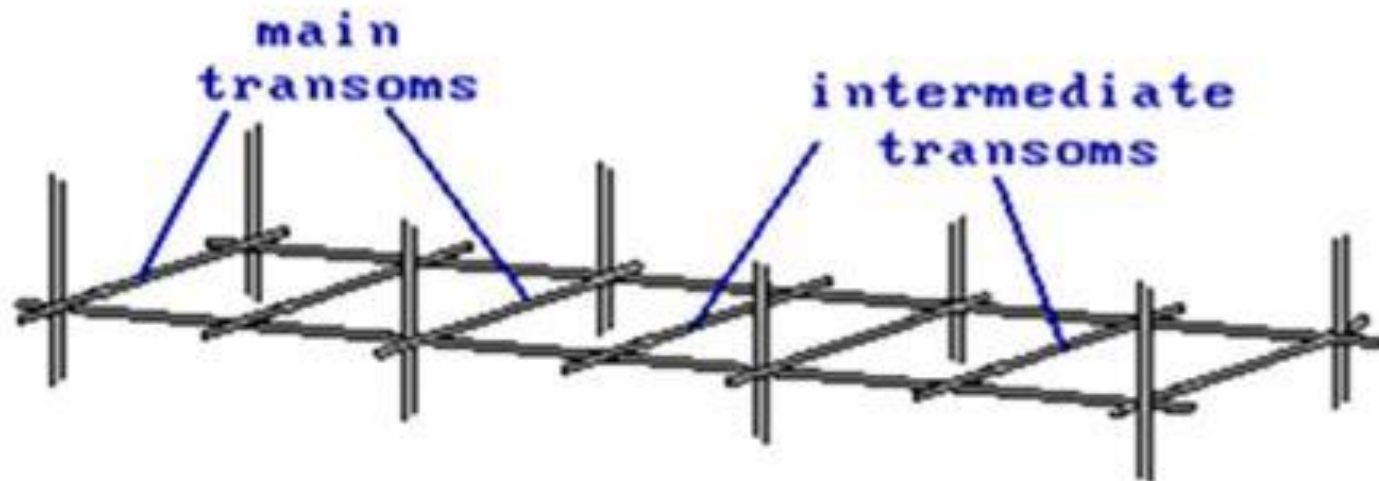
Transoms

Main transoms are either:

- ❑ Fixed directly across to every pair of standards, using right-angle coupler or laid across and fixed to ledgers with putlog couplers.
- ❑ Transoms should be fixed as close as possible, but never more than 300 mm from each pair of standards.



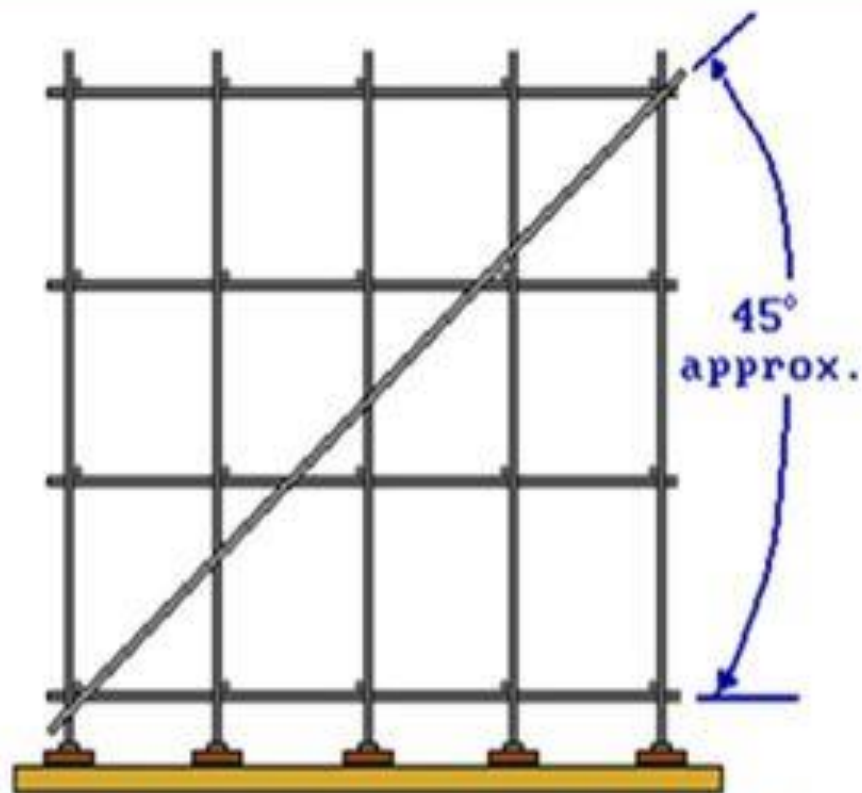
Transoms



Intermediate transoms are fixed across ledgers with putlog couplers, normally in the centre of each bay, although additional intermediate transoms may be required to support short boards; they may be removed when the working platform is no longer required.

Bracing

Facade (or sway braces) should be fitted along the outer face of the scaffold, from the base to the full height of the structure.



All scaffold structures must be braced to prevent movement or distortion.

Bracing

- ❑ Cross or ledger bracing connects the front row of standards to the back row and is put on every alternate pair of standards.
- ❑ Cross bracing put directly on the standard serves the same purpose.
- ❑ Joints in facade braces must be made with sleeve couplers; if joint pins (spigots) are used each joint must be spliced with a lapped tube

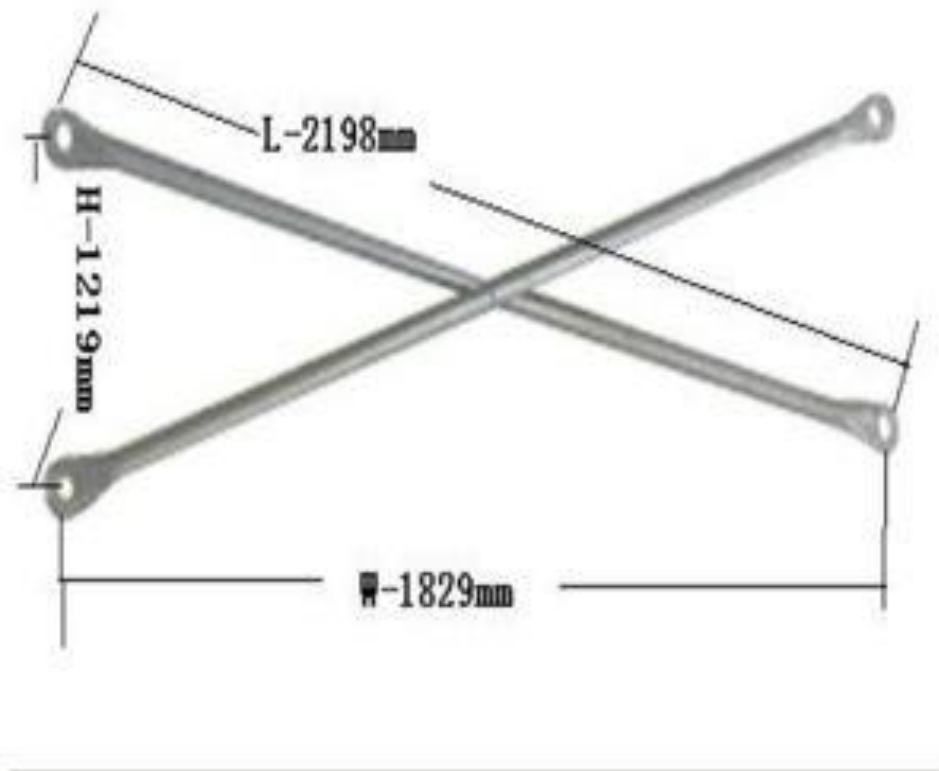
Bracing

- ❑ Braces must be connected at every lift to standards with swivel couplers, or to the end of transoms with right-angle couplers, in which case the transom itself must be fixed with right-angle couplers
- ❑ All braces form an essential part of the scaffold and must not be removed without expert advice and then only by a competent person

Bracing

When inspecting bracing:

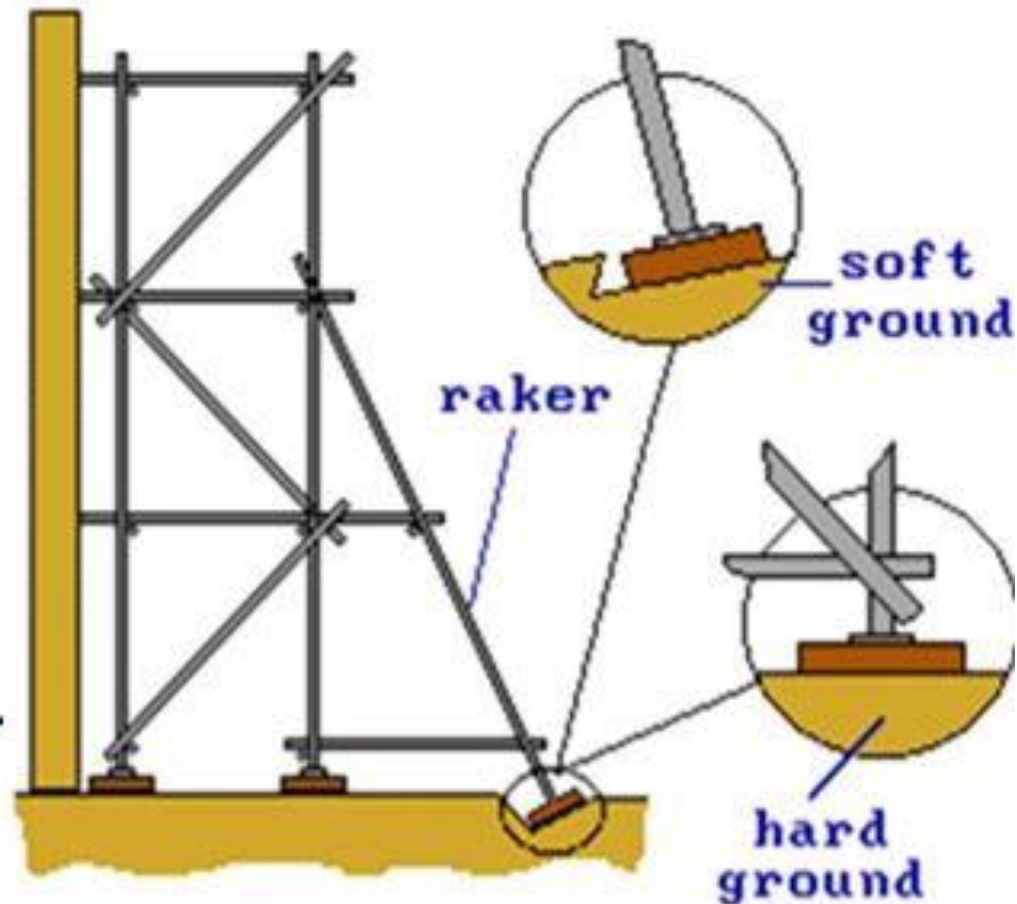
- Bracing start at base and continue to the full height of the scaffold
- Any parts missing?
- Correct fittings and couplers used
- Bracing securely fixed
- In good condition



Rakers

Where it is impractical to provide normal ties, the stability of a scaffold can be achieved by the use of rakers.

The foot of the raking tube must be well founded and always be tied back to the main scaffold. This arrangement can be used instead of a single tie.



Scaffold Ties

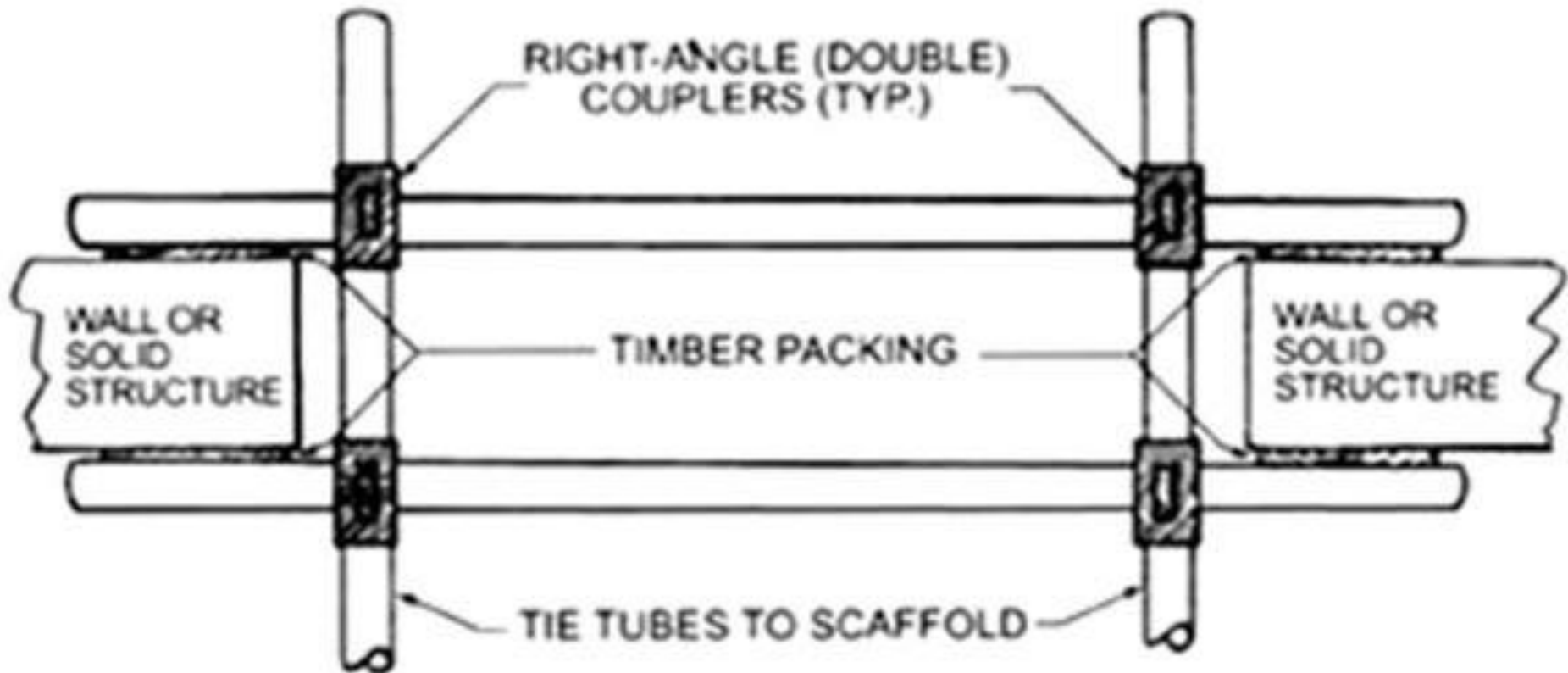
- ❑ To ensure that the scaffold framework is stable and cannot move away from and towards the building, it must be stabilized. This is normally achieved by securing the scaffold framework to the building with positive two-way ties.
- ❑ Ties must not be removed except by an experienced and competent scaffolder, who must ensure that the stability of the scaffold is not affected.

There are 5 main types of tie:

1. Through tie
2. Box tie
3. Lip tie
4. Screw or Anchor tie
5. Reveal tie

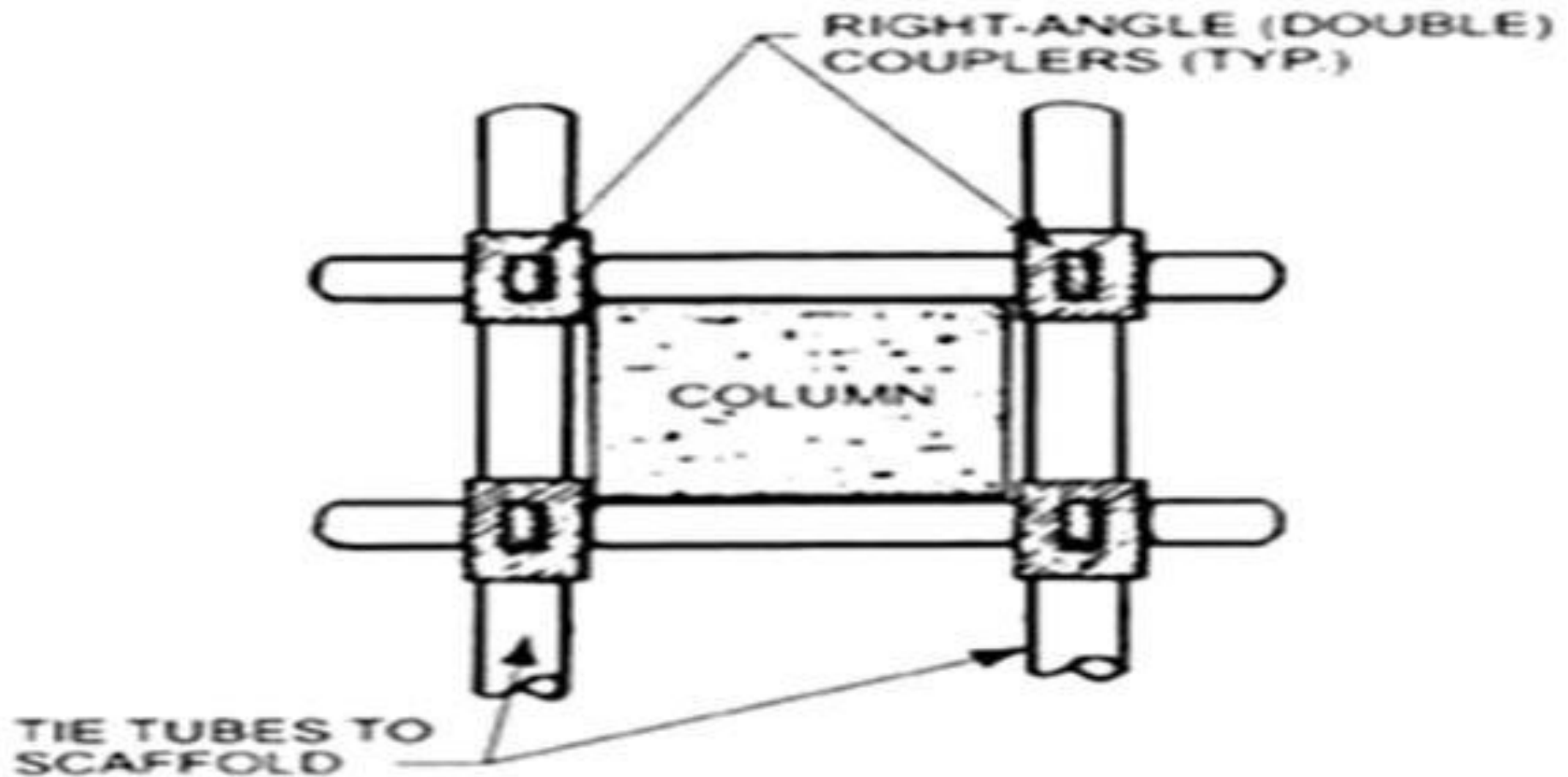
Scaffold Ties

Two-way Ties



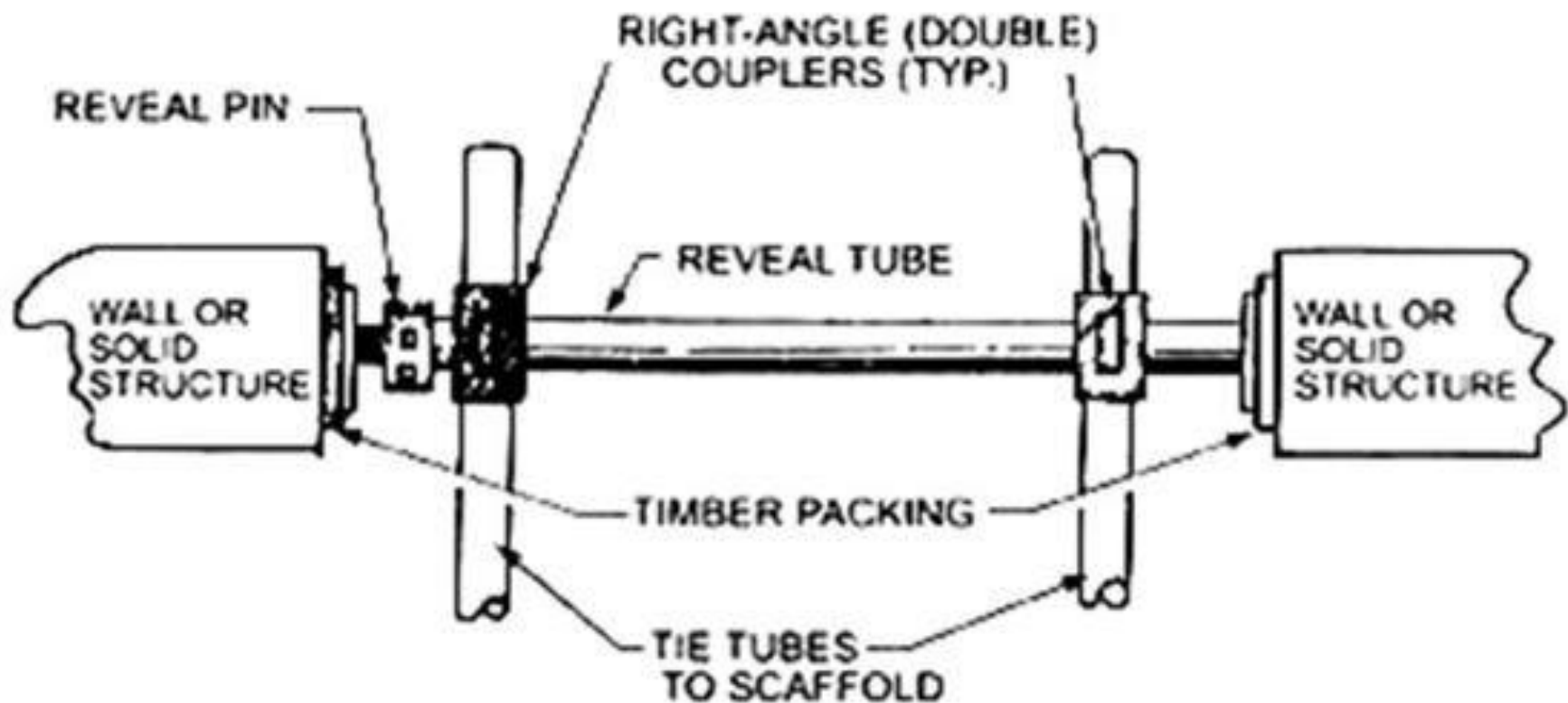
Scaffold Ties

Column Box Ties



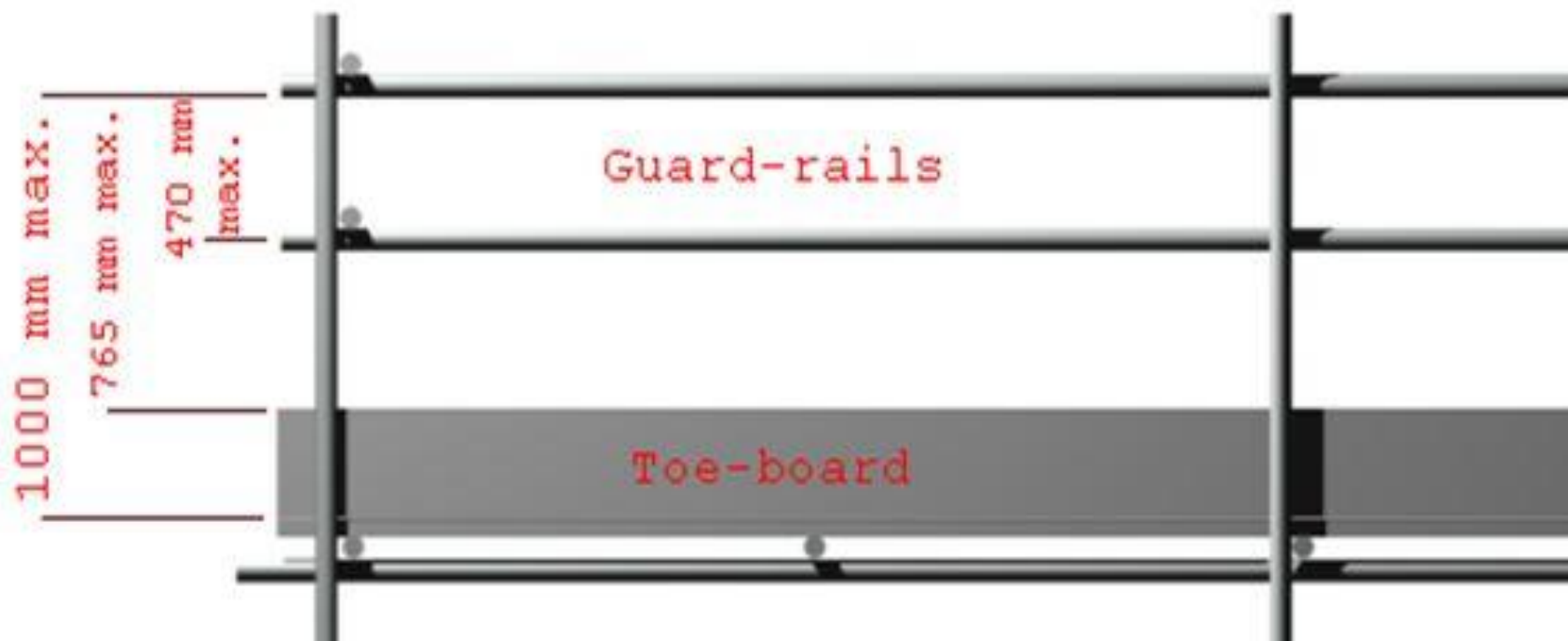
Scaffold Ties

Reveal Ties



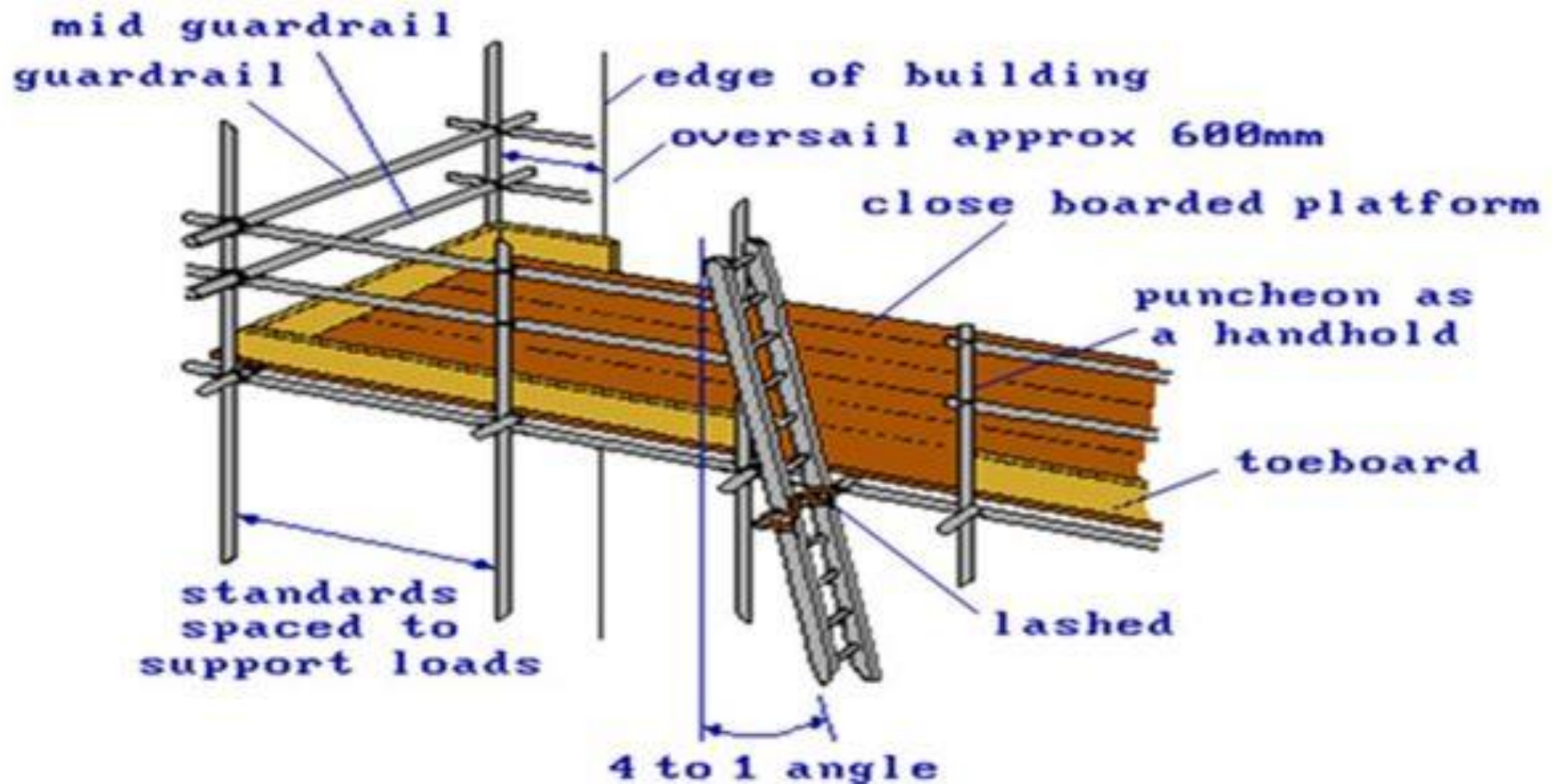
Guard-rails and Toe-boards

- ❑ Guardrails must be provided where persons can fall 2m or more, at least 910mm above the platform and fixed inside the standards.
- ❑ Toe boards must accompany guardrails and fixed inside the standard with proper clips.

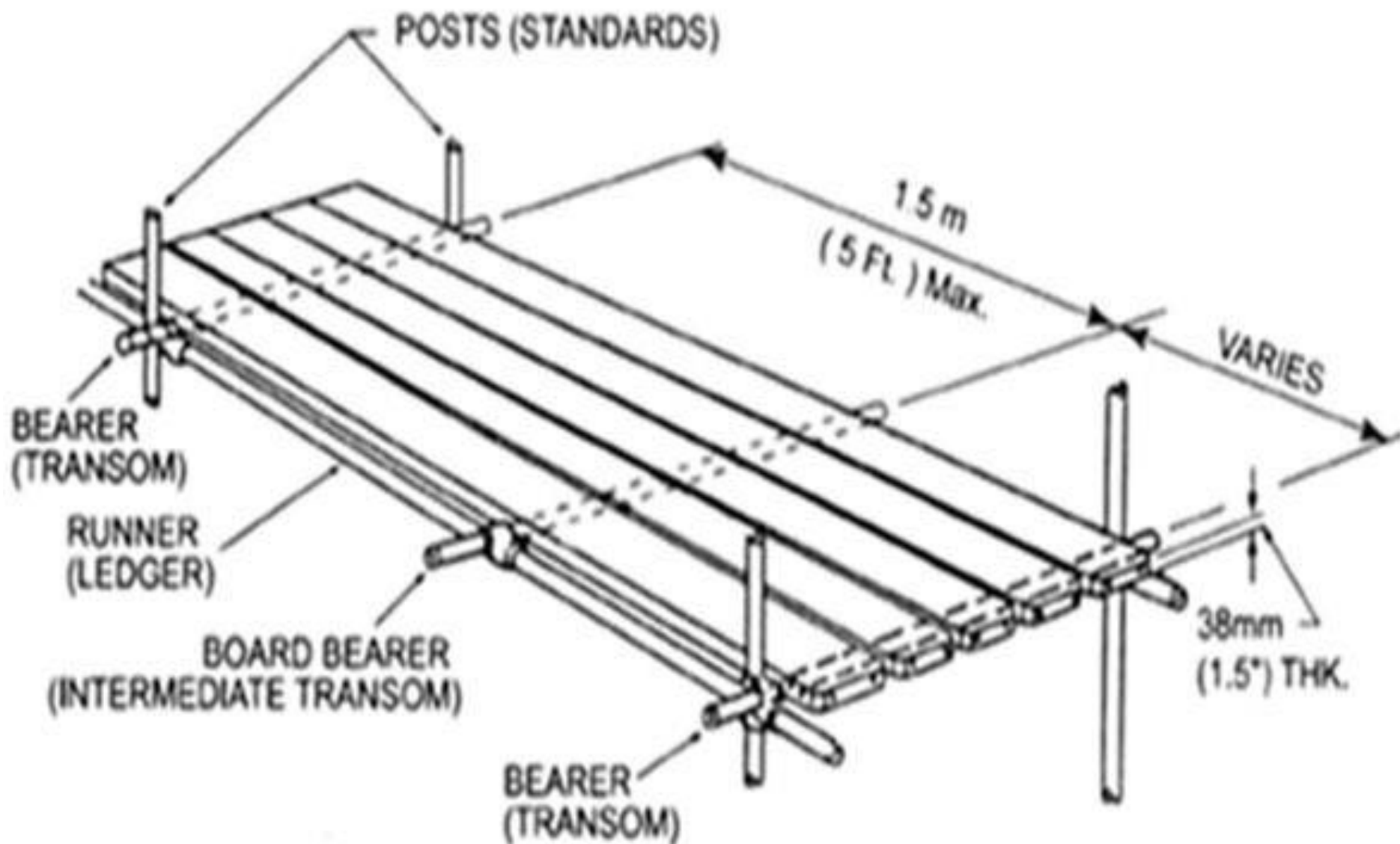


Working Platform

The minimum requirement for a working platform is for a width of 600 mm, irrespective of whether it is a trestle scaffold or a scaffold surrounding a multi-storey building.

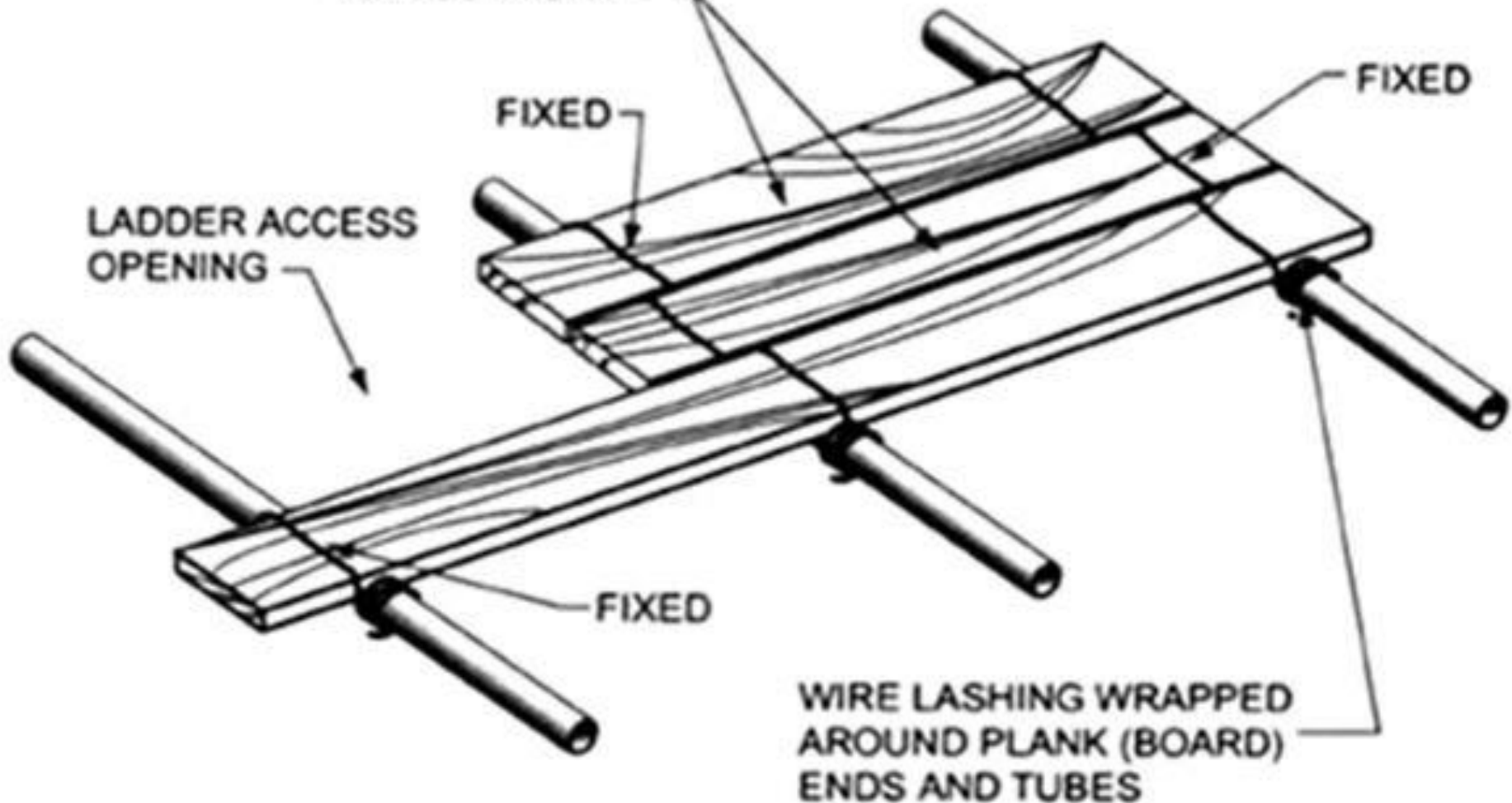


Working Platform

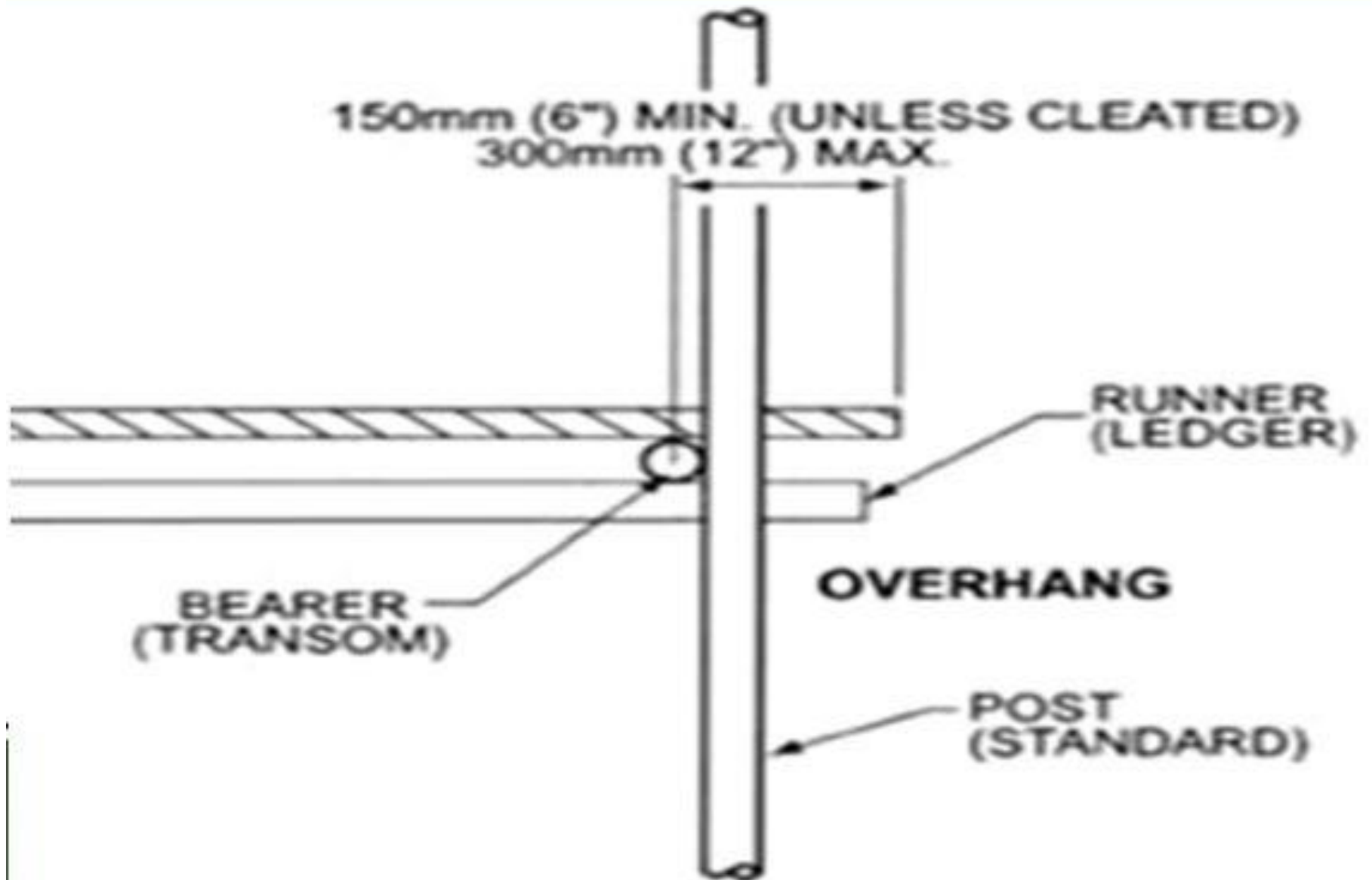


Working Platform

EACH END OF PLANKS (BOARDS) UP TO
1.8m (6 Ft.) LONG FIXED
TO A SUPPORT



Working Platform

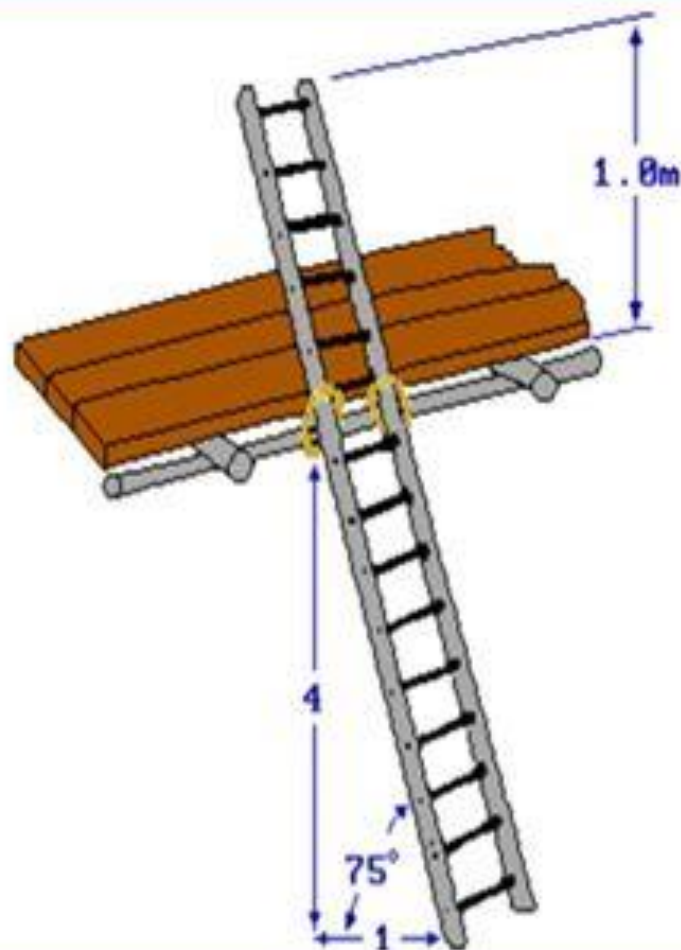


Ladder

Access:

Access to a working platform is usually by a ladder.

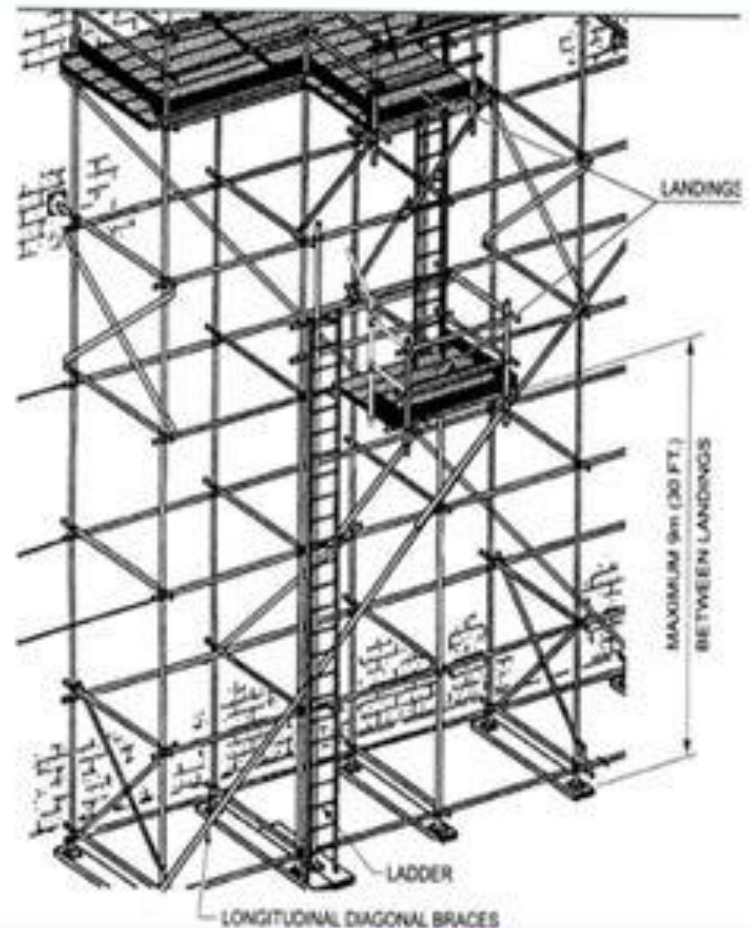
The ladder must be secured near the top and extended above the level of the platform by a minimum of five rungs (1 m) unless adequate handholds are provided.



Ladder

The vertical run between landings must not exceed 9m.

Care must be taken to see that there is adequate space between rungs to give firm foothold and that there is no possibility of the foot being trapped between a rung and a ledger, transom or brace tube.

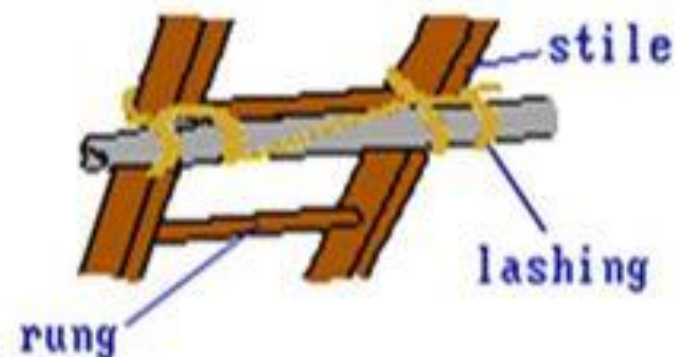


Ladder

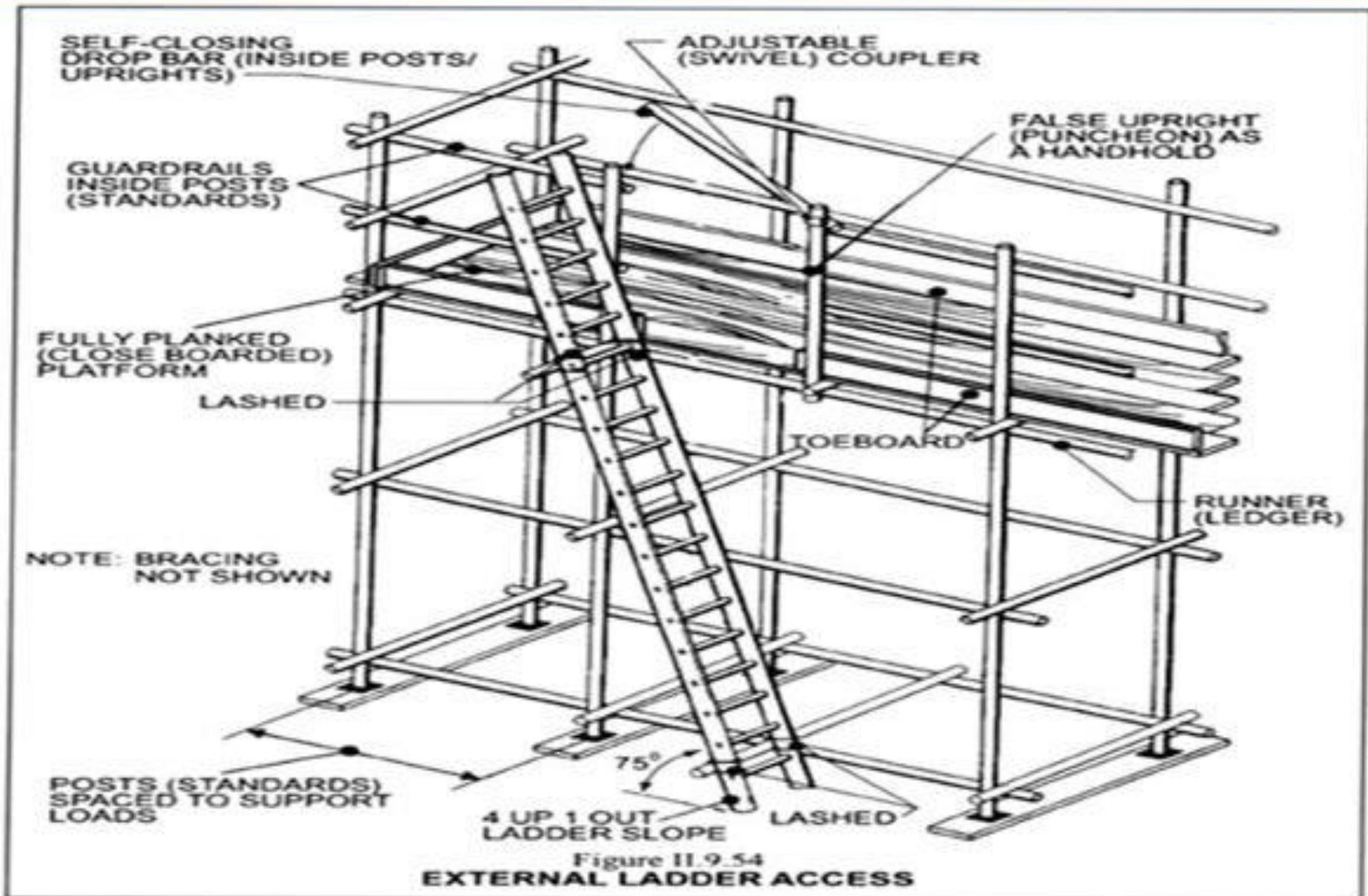
Ladders must be lashed by the stiles, **NEVER** to the rungs.

Both stiles of the ladder should rest on firm, level ground.

On soft ground a board should be used to stand the ladder on.



Ladder



Ladder

Extension ladders with long sections.

The minimum recommended overlap on extension ladders is as follows:

Closed length	Appr. No. of rungs	Overlap of rungs
Under 5 M	under 18	2
5 – 6 M	18 – 23	3
Over 6 M	over 23	4

Latching hooks must be properly engaged.

Ladders **MUST NOT** be lashed or spliced together

Putlog Scaffold

Put log Scaffold



Putlog scaffolds, sometimes called bricklayers' scaffolds, depend for their support on the walls of the building on their inner side, and rows of standards on their outer side.

Putlog Scaffold

General purpose putlog scaffold:

Maximum standard spacing	- 2.1 m
Maximum loading	- 200 kg/m ²
Minimum board width	- 5

Heavy duty putlog scaffold:

Maximum standard spacing	- 2 m
Maximum loading	- 250 kg/m ²
Minimum board width	- 5
Average lift height	- 1.35 m
Maximum height	- 50 m

Birdcage Scaffold



The birdcage scaffold is so called because of its appearance. It is normally an internal scaffold and is mainly used for ceiling work in large halls. It consists of an arrangement of standards with ledgers and transoms supporting a closely boarded platform at the required level.

Birdcage Scaffold

Maximum standards spacing	- 2.5 m
Maximum first lift height	- 2 m
Remaining lifts (approx.)	- 2 m
Working platforms	- 1
Distributed loading	- 75 kg/m ²
Maximum height	- 50 m

Mobile Tower

- ❑ A mobile tower is a scaffold mounted on wheels or castors. It usually consists of 4 standards and is square in construction.
- ❑ It can consist either of ordinary tubes and fittings or be a system scaffold using ready made frames.
- ❑ Mobile towers built with tubes and fittings must be built by or under the direct supervision of competent scaffolders.



Tower Scaffold (Static)

- ❑ These towers are freestanding, but may be tied to a permanent structure, depending on its design and function.
- ❑ If it is used independently, it should be anchored with guy wires.



Tower Scaffold (Static)

Maximum Standard Spacing	2.5 m
Minimum Standard Spacing	1.2 m
Maximum height of lift	2.5 m

Freestanding Heights:

4 to 1	Static Internal
3.5 to 1	Static External
3.5 to 1	Mobile Internal
3 to 1	Mobile External

Tied at 9.6m

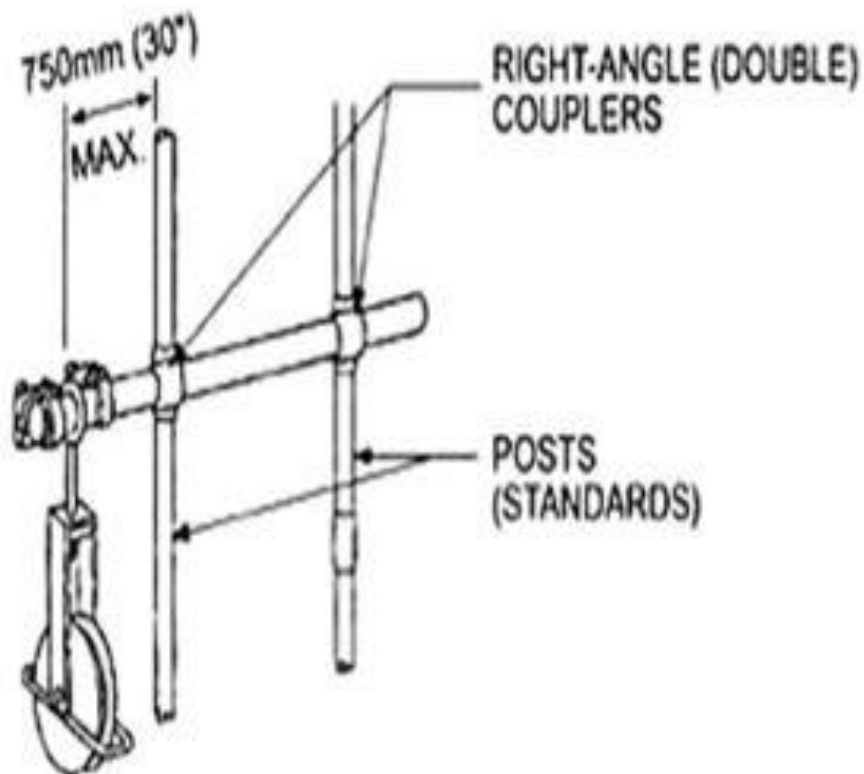
Working platform 1

Distributed Loading 150 kg./m²

Gin Wheels

B.S. 5973

Maximum load of 50kg on single tube outrigger with a maximum suspension point of 750 mm



RING TYPE GIN WHEEL (PREFERRED)

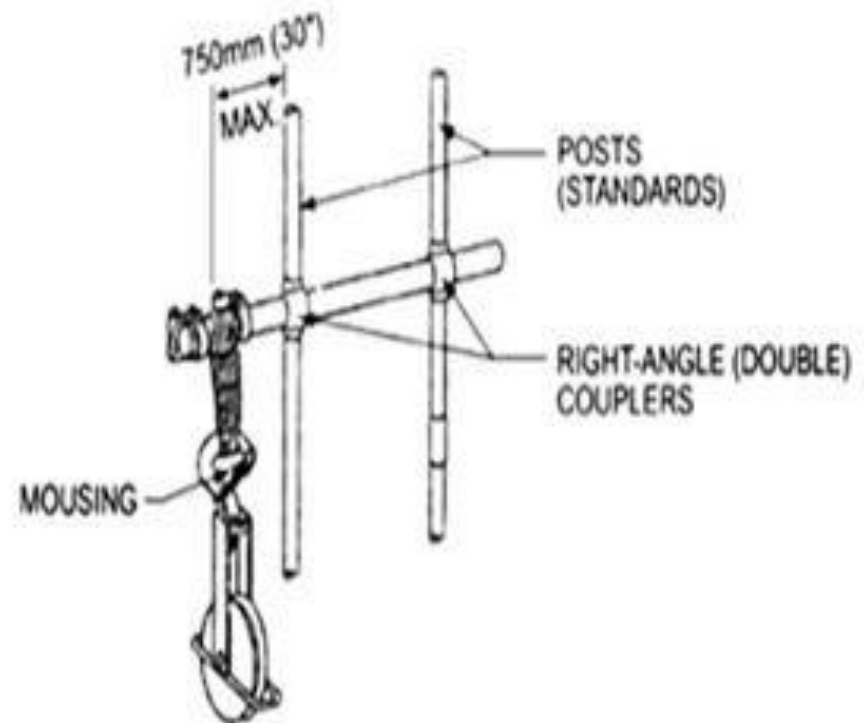


Figure 11.9.53
HOOK TYPE GIN WHEEL

Independent Scaffold

Indepen. tied scaffold	Use of platform	Max. no. of platforms	Widths, using 225 mm boards	Max. standard spacing	Distributed load on platforms
Very light duty	Inspection Painting Stone cleaning Light cleaning Access	1 working platform	3 boards	2.7 m	75 kg / m ²
Light duty	Plastering Painting Stone cleaning Glazing Pointing	2 working platforms	4 boards	2.4 m	150 kg / m ²

Scaffold Duty / Load Distribution

Indepen. tied scaffold	Use of platform	Max. no. of platforms	Widths, using 225 mm boards	Max. standard spacing	Distributed load on platforms
General purpose	Gen. building work Brickwork Window & mullion fixing rendering plastering	2 working platforms & 1 at very light duty	5 boards or 4 boards & 1 inside	2.1 m	200 kg / m ² & 75 kg / m ²
Heavy duty	Blockwork Brickwork Heavy cladding	2 working platforms & 1 at very light duty	boards or 5 boards & 1 inside or 4 boards & 1 inside	2.0	250 kg / m ² & 75 kg / m ²
Masonry duty or special	Masonry work Concrete blockwork Very heavy cladding	1 working platform & 1 at very light duty	6-8 boards	1.8 m	300 kg / m ² & 75 kg / m ²

Practical Exercise

1. Sequence of Scaffolding Erection
2. Birdcage Scaffold Erection
3. Independent Scaffold Erection
4. Mobile Tower Scaffold Erection
5. Sequence of Dismantling Scaffolding