



# NEBOSH International Certificate in Construction Safety and Health

## Unit ICC1

MANAGING AND CONTROLLING HAZARDS IN INTERNATIONAL  
CONSTRUCTION ACTIVITIES

ELEMENT 10: WORKING AT HEIGHT - HAZARDS AND RISK CONTROL

SAMPLE MATERIAL

(Material correct at 1/11/2011)



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## Element 10: Working at Height - Hazards and Risk Control

### Safe Working Practices for Access Equipment and Roofwork



#### Key Information

- Scaffolding provides access to work at height and includes independent tied, putlog, fan, cantilevered and mobile tower scaffolds.
- Safety features of scaffolding include sole boards and base plates for ground support; toeboards and guardrails to prevent falls; and boarding, brickguards and debris netting to retain materials, equipment and debris.
- Scaffold erectors must be properly trained and qualified to erect, maintain and dismantle scaffolding.
- Safe access onto and off scaffolding has to be provided, and loading platforms must be suitable and strong enough to support the work.
- Various equipment and personnel hoists are available to move people and materials on and off scaffolding and building structures.
- Scaffolding must be stable, and its structural integrity must not be affected by loading of people, equipment and materials or adverse weather conditions. It must be protected from impact by vehicles.
- Mobile elevating work platforms (MEWPs) offer a portable alternative to full scaffolding in some situations.
- Other access equipment includes ladders, stepladders, trestles and staging. Where roof work is next to a gap or edge, then further leading edge protection is required.
- Other techniques include boatswain's chair, cradles and rope access systems.
- Fall arrest systems include harnesses, safety nets, soft landing systems and crash decks. Rescue and emergency procedures should be in place when using these techniques.
- Safe roof work requires safe access, edge and leading edge protection, crawling boards on fragile materials and possibly fall arrest equipment.

#### Scaffolding

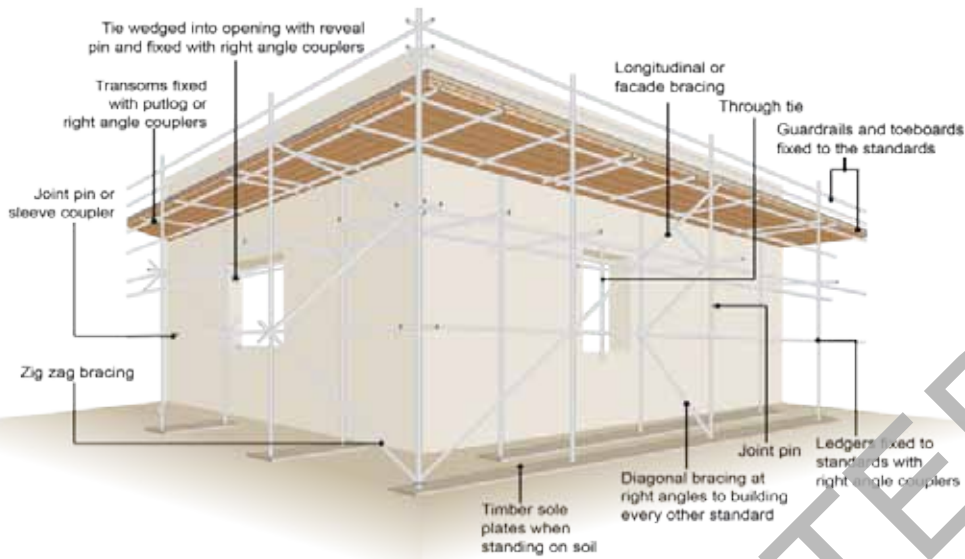
##### Features of Different Types of Scaffold

##### Independent Tied Scaffolds

Scaffolding is made up of the following basic components:

- **Standards** – uprights or vertical tubes used to support the load to the ground.
- **Ledgers** – short horizontal tubes tying the structure together longitudinally, usually running parallel to the face of the building.
- **Transoms** – short horizontal tubes spanning across ledgers normally at right angles (90°) to the face of the building. They may also be used to support a working platform.
- **Bracing** – diagonal tubes to give the structure its rigidity.
- **Base plates** – small square metal plates that the standards (uprights) rest on to prevent them sinking into the ground.
- **Sole boards** – large pieces of timber put under the base plates to spread the load over a wider surface area when the scaffold is erected on soft ground.
- **Work platform** – the fully boarded work area surface.
- **Guardrails** – fixed to the standards (uprights) to fully enclose the work platform.
- **Toeboards** – fixed to the standards (uprights) to provide a lip at the platform edges.

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*Independent Tied Scaffold*

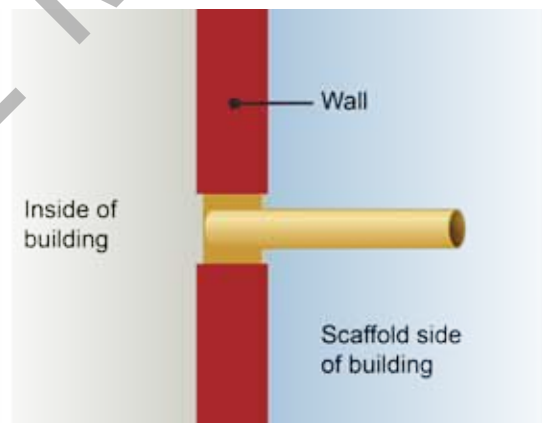
An independent tied scaffold is designed to carry its own weight and the full load of all materials and workers on the platform. It must be tied to the building where it is sited, to give stability and prevent movement.

As the total weight of the structure is supported by the ground it is very important that the ground conditions are suitable to cope with the load. Base plates and sole boards may be used to spread the weight over a large surface area.

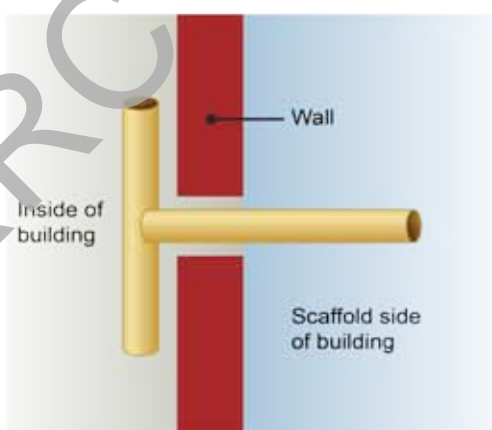
There are a number of ways in which the scaffold can be tied to the building to prevent movement:

- **Anchor bolts** – where one end of a metal bolt is screwed into the wall of the building and the other end is attached to the scaffold tubing.
- **Through ties** – where a scaffold tube extends into the building through an opening (e.g. a doorway or window frame). The end of the tube inside the building is coupled to another tube bridging across the opening.

- **Reveal ties** – where a scaffold tube is coupled to a reveal pin that is wedged tightly across an opening such as a window reveal.



*Plan View of a Reveal Tie*

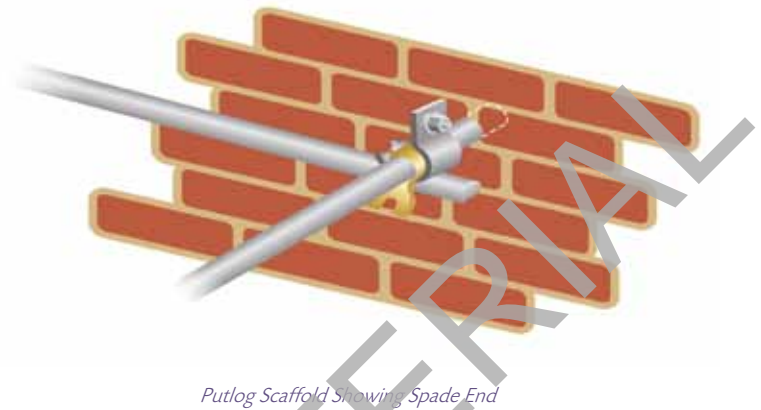
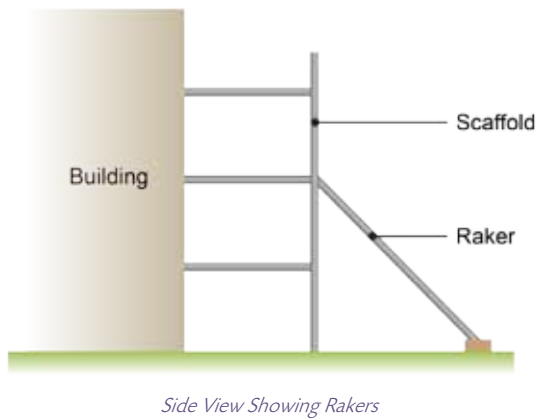


*Through Tie (as seen from above)*



## Element 10: Working at Height - Hazards and Risk Control

- **Rakers** – supports which push the scaffold onto the building. This system takes up space and may not be suitable in urban environments.



**Bracing** is another important component of the scaffold and is used to stiffen the scaffold framework to prevent collapse.

The basic forms of bracing are:

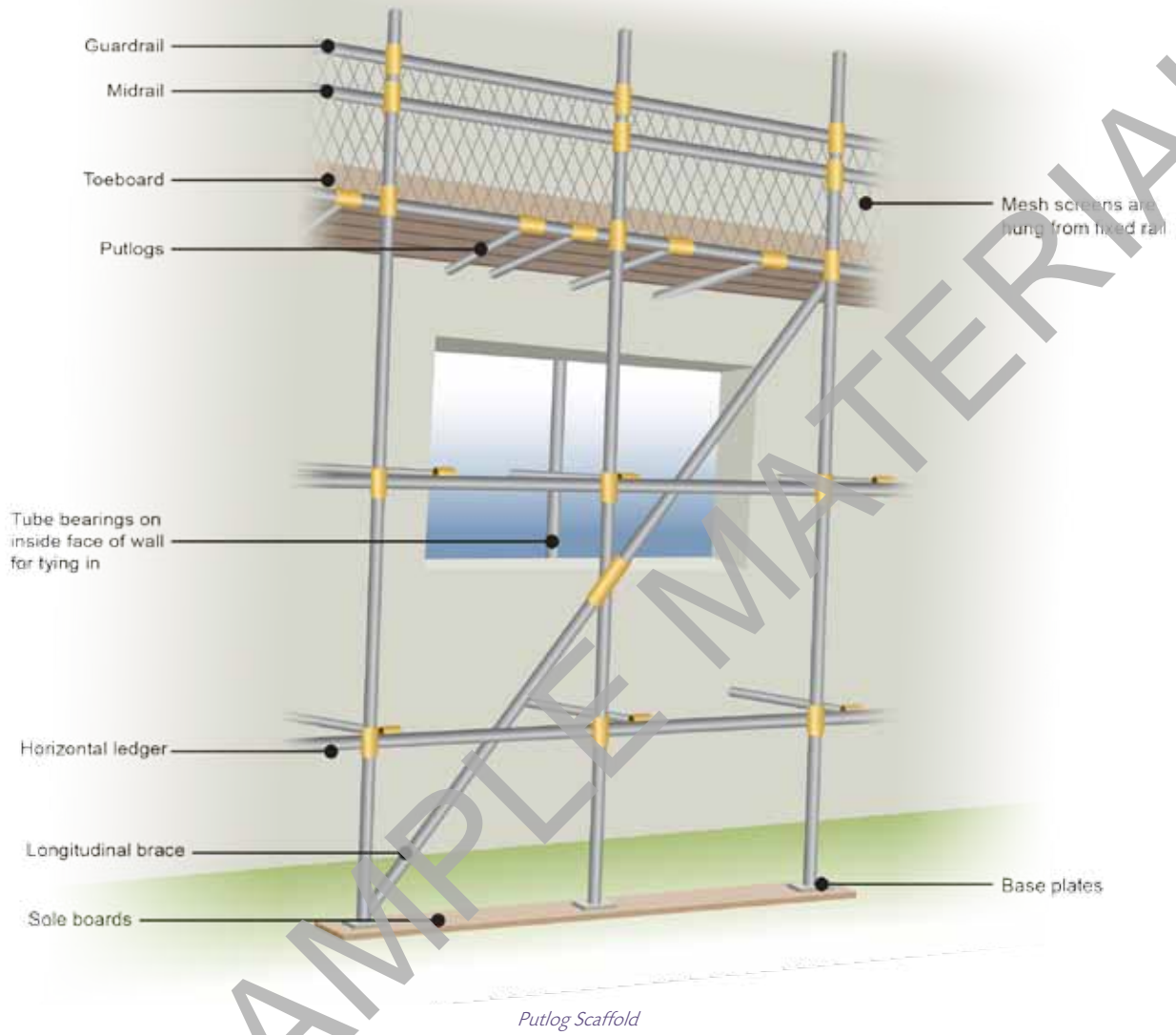
- **Facade bracing** – scaffold tubes running diagonally across the face of the scaffold. This is also known as sway and longitudinal bracing.
- **Ledger bracing** – scaffold tubes running diagonally within the framework. Alternate pairs of standards should have ledger bracing.

### Putlog Scaffold

A putlog is a tube spanning from the ledger to the wall of a building on a putlog scaffold. It is fixed into the brickwork by a specially formed flattened end (spade end) which may be constructed on a scaffold tube, or by using a detachable fitting (putlog end) with the spade end of the putlog fully home (75 mm) in the brickwork (bed joint).



Putlog End





## Element 10: Working at Height - Hazards and Risk Control



### Topic Focus

#### Scaffold Inspections

These are carried out:

- After erection and before first use.
- Every seven days.
- After any adverse event, e.g. bad weather, impact from vehicle, or large object falling into it.

The inspector should look for:

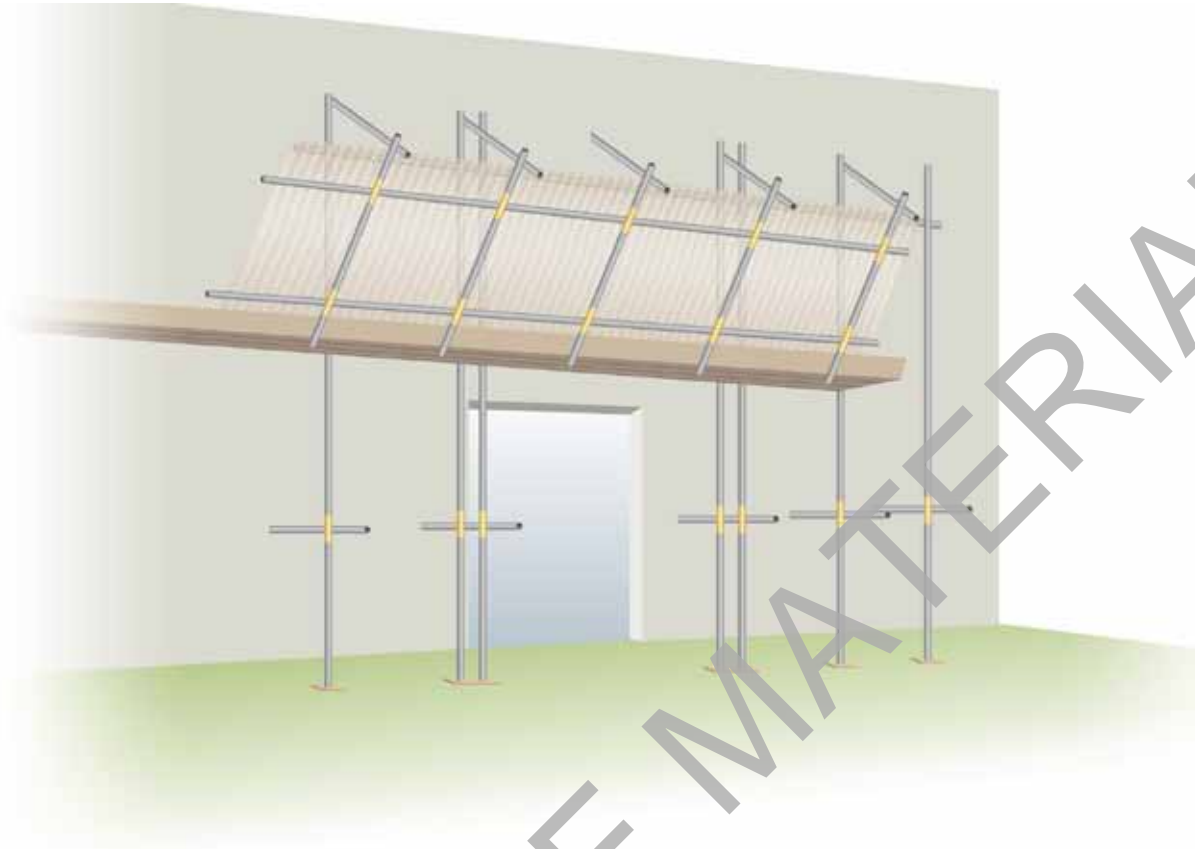
- Adequate foundation: level, firm ground (use baseplates central on sole boards/plates).
- Platform: fully boarded three to five boards wide (depends on use).
- Scaffold boards: each to have at least three supports and be tied down (overhang not more than 150 mm).
- All tubes and fittings in good condition.
- Vertical supports: no more than 2 to 2.5 m apart.
- Bracing: along diagonals at the faces and at right angles.
- Ties: into the building at least every 4 m vertically and 6 m horizontally.
- Guardrails and toeboards: secure along outer edges and ends.
- Toeboards: minimum of 150 mm high.
- Guardrails: 950 mm above the platform; double guardrail at 460 mm.
- Appropriate access.
- Ladders: good condition (correctly sited, tied, sufficient length and number, etc.).
- Loading: do not overload; stack any material correctly and securely.

Additionally for a **putlog scaffold**, checks are needed on the spacing of putlogs and to see that the spade end of the putlog is fully home (75 mm) in the brickwork (bed joint).

**(Please note that these and other dimensions quoted are from UK guidance and should be regarded as good practice unless determined differently by national or local regulations.)**

#### Fan Protection

Fans or protected walkways are often used to protect members of the public from falling materials and debris from work carried out in busy city centres, but can equally be used on construction or refurbishment projects.



Fan Protection

### Cantilevered Scaffold

A cantilever scaffold is an independent scaffold entirely supported by the building. The scaffold has a framework inside the building, wedged between floors and ceilings. The cantilever tubes are fixed to this frame and supported. Rakers bearing on sills or ledges on the face of the building support the outer ends of the tubes. Buildings should be checked to ensure they can support the intended loads.

### Truss Out Scaffolding

This is used:

- Where it is not practical to build scaffolding from ground level.
- For lightweight work, e.g. stone or paintwork cleaning on tall buildings.

This scaffold has horizontal cantilever tubes passed in through windows and anchored to vertical tubes against wooden packing pieces against an inner wall. Rakers bearing on sills or ledges on the face of the building support the outer ends of the tubes.

### Birdcage Scaffolding

This is normally used for working inside factories, cinemas, churches or tall buildings. It can be used to gain access to ceilings and walls for plastering, painting or decorating.

### Scaffolding Hazards

**Key hazards** associated with the use of scaffolds:

- Falls from the work platform.
- Objects falling from the platform.
- Collapse of the structure.

Scaffolds should be erected by trained workers and inspected by competent persons.



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### Topic Focus

#### Factors that might cause the collapse of an independent tied scaffold:

- Overloaded work platform.
- Scaffold built on soft ground without sole boards.
- Scaffold not adequately tied to building.
- Insufficient bracing incorporated into scaffold.
- Standards not upright.
- Standards bent, buckled or heavily corroded.
- High winds.
- Incorrect couplers used to join tubes together.
- Scaffold struck by mobile plant.
- Scaffold erected by incompetent workers.
- Scaffold not properly inspected.

#### Mobile Tower Scaffolds

Commonly used for painting and simple maintenance jobs inside and outside buildings, they are only light-duty scaffolds. They have one working platform at the top, accessible by fitted internal ladders. They can use scaffold tubes, but most use proprietary-made structures. The assembled tower is mounted on wheels and can be easily moved. They are to be built to manufacturers' instructions by competent persons.



*A worker gains entry to the top of a tower scaffold using internally fixed ladders, through internal trapdoors. This tower has outriggers attached.*

Height of a mobile tower should be limited to 12 metres except for special purposes. For internal use, the height should not exceed three and a half times the shortest base dimension (e.g. if the base dimension is 1 m x 1 m the maximum height will be 3.5 x 1 m = 3.5 m). For external use, the factor is reduced to three. When a mobile scaffold is used above 9.8 metres, a guy rope, ballast or anchoring device must be used to increase stability. Outriggers will spread the base dimensions and increase stability.

Duties regarding edge protection, overloading and inspections are the same as for other scaffolds/working platforms.

#### Main hazards associated with mobile tower scaffolds:

- Falls from the work platform.
- Objects falling from the platform.
- Collapse of the structure.
- Overturn (toppling) of the structure.
- Unintended movement of the wheels.
- Contact with live overhead cables or other services.





## Topic Focus

### Safety precautions for safe use of mobile tower scaffolds:

- Guardrail fitted to the work platform.
- Tower must not be overloaded.
- Wheels should be locked when tower is in use.
- Tower must be sited on firm, level ground.
- Never move towers with people or materials on them.
- Avoid overhead services during use and movement.
- Use outriggers where necessary to increase stability.
- Never climb up the outside of a tower.
- Towers must be assembled by trained workers.

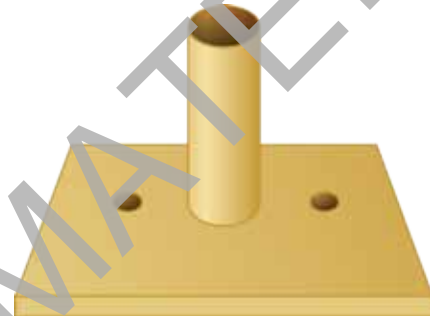
## Safety Features of Scaffolding

### Sole Boards

The sole board is a strong timber plank wider than a base plate and long enough to be positioned under two base plates (see Putlog Scaffold earlier). Sole boards spread the load for the scaffold base. They must be used on soft ground (it is good safety practice to use them for all scaffolds).

### Base Plates

A base plate is a flat, square steel plate with a locating pin that must be inserted into the bottom of a standard to provide a bearing surface for load distribution.



Base Plate



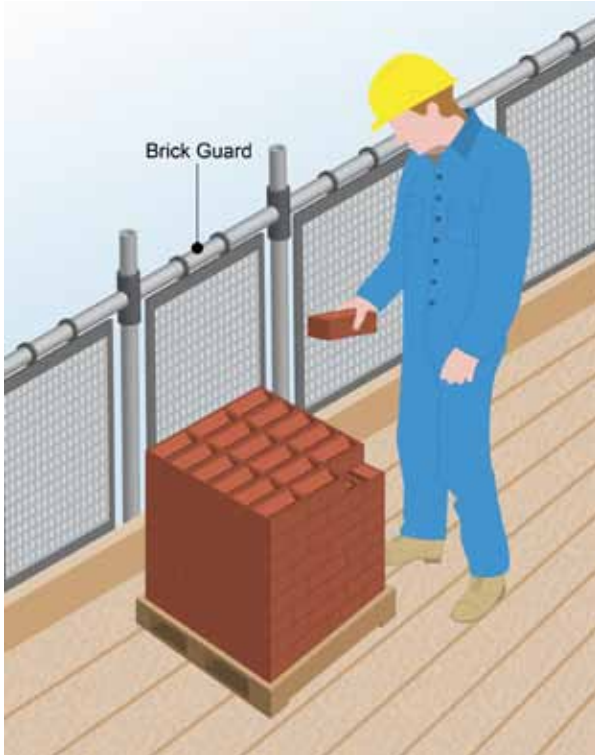
Mobile Scaffold Tower

### Toeboards, Guardrails and Brickguards

Safeguards must be provided for all unprotected edges on scaffolds and platforms. Guardrails will prevent people from falling. Toeboards and brickguards are designed to stop materials from falling.



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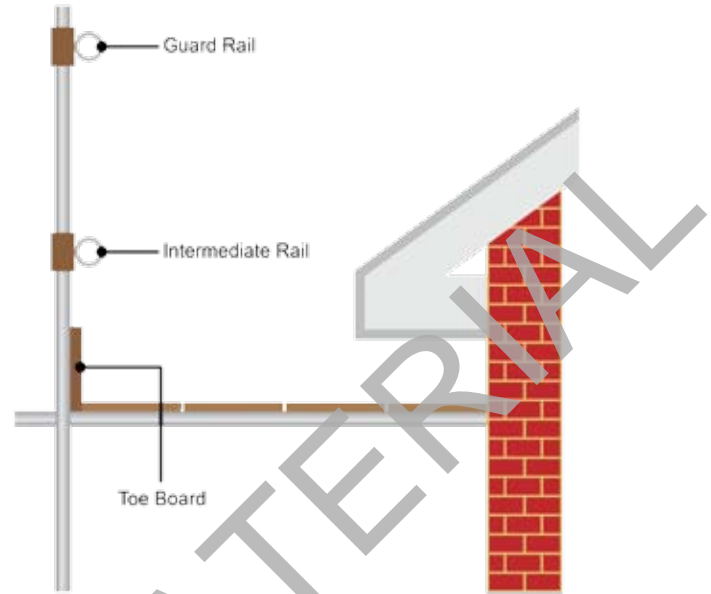
Use of a Brickguard

**Toeboards** are usually scaffold planks laid on their edge at right angles (90°) to the working platform. They are laid at the outer edges and ends of the working platform (sometimes the inner edge - the one nearest the building - may require them). Toeboards prevent small objects, e.g. rubble and tools, from being casually kicked off the platform. If material is stored above toeboard height then additional boards, **brickguards** (mesh panels), or similar mesh covering are used to prevent material from falling and have a secondary function of helping prevent people from falling as well.

Detailed requirements for edge protection are:

- Top guardrail to be at least 950 millimetres above the working platform.
- Intermediate rails so no unprotected gap of more than 470 mm between toeboard and guardrail.
- Toeboard must extend to at least 150 mm above the working platform.

These arrangements are shown in the following figure which also illustrates the use of the scaffold platform in preventing falls from a sloping roof. The same arrangements apply in preventing falls in respect of flat roofs, and also other forms of edge protection such as mobile tower scaffolds, mobile elevating work platforms and elevated walkways.



Edge Protection on a Sloping Roof with Guardrails and Toeboards

### Boarding

An intermediate guardrail does not have to be used, although there must be no vertical gaps exceeding 470 millimetres. **Boarding** consisting of several toeboards stacked one on top of the other could be used instead, or a brickguard hung from the main guardrail and attached to the platform, providing this could support/contain a person in the event of a slip or fall (in which case, it might be possible to do away with the toeboard).

Gaps are allowed in edge protection, provided they are the minimum required for reasonable access.

As an alternative, or when space is limited, barriers or fencing can also be erected around roof edges using scaffolding tubes and boards. These must extend at least 400 millimetres above the roof surface and the upper guardrail must be at least 910 millimetres above the roof surface.

### Debris Netting

Safety nets can also be used to prevent waste material or debris from falling by using them in the shape of a fan to protect those below. In order to achieve this, overlay nets are laid over the safety nets. Care must be taken to ensure that both the size and spacing of the overlay net are in line with the type of material falling on it, e.g. 12 to 19 mm. As with safety nets they require to be attached to the supporting framework with tie cords, hooks, rings or thimbles and should be double the strength of the net. Such nets should not be allowed to accumulate debris above a certain weight as specially designed nets are required for this purpose. The nets should be cleaned, inspected and stored in accordance with the precautions outlined for safety nets (see later) by a competent person.

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### Waste Chutes

These are often used to dispose of debris and waste materials from scaffolding and roofwork in general, which is then transferred to landfill or waste transfer stations. Precautions must be taken when the skips are removed for disposal and to avoid use of waste chutes by children as a slide (e.g. they should be capped).



*An independent tied scaffold with guardrails and toeboards, and a debris chute for safe removal of rubble*

- Setting up hoists or lifting appliances.
- Operating mobile access platforms.
- Rigging and inspection of safety nets.
- Application of the national or local regulations regarding construction and working at height in the operations above.

Scaffolders are classified as basic (one year of experience) or advanced (two years' experience including one year as a basic scaffolder). New entrants are called trainee scaffolders.

### Means of Access

Access onto scaffolding is normally by use of ladders, which should be put in place as early as possible in the erection process and removed as late as possible in the dismantling process. Access to scaffolding for people and materials might also be gained by using hoists and mobile elevating platforms (discussed later in this section).

### Requirements for Scaffold Erectors

Scaffold erection is a skilled and potentially dangerous occupation, and requires the necessary capability and fitness, skill, experience, knowledge and competence to complete scaffolding operations safely.

Anyone engaged in work at height and the use of work equipment for work at height, including organisation, planning and supervision, must be competent to do so. If being trained, they are to be supervised by a competent person.

**Scaffold erectors** need to be trained in:

- Safe systems of work.
- Risks associated with scaffolding and with any particular work involved.
- Assessing site conditions.
- Use of PPE.
- Erecting, adapting and dismantling different types of scaffolding.