

# N2

## Bricklaying and Plastering Theory

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## What is covered?

Building structures are often very high and it may be difficult to reach areas that need to be worked on. If you need to work on a tall structure, such as plaster bricks, for example, and you cannot reach, then scaffolds, trestles or ladders will be very useful. This is why knowing how to safely erect and dismantle scaffolds and trestles are an important part of the building process.

In this module, you will learn about the different types of scaffolds and trestles and how to safely erect and dismantle them. How to safely climb extension and step ladders, as well as how to properly care for and store them will also be covered in this module.

### Learning outcomes

After studying this module, you should be able to:

#### Unit 1

- define different types of scaffolding and trestles

#### Unit 2

- explain the spacing of trestles
- describe how trestle scaffolding is erected
- explain the dismantling of trestle scaffolding

#### Unit 3

- explain how extension ladders are erected
- describe and explain extracts from safety regulations
- describe correct climbing procedure
- explain proper care and storage of ladders

#### Unit 4

- describe and explain extracts from safety regulation
- describe correct climbing procedure
- explain proper care and storage of step ladders

#### Unit 5

- define metal scaffolding
- name and describe different types of metal scaffolding.

# Unit 1: Types of scaffolding and trestles

## LEARNING OUTCOME

- Define different types of scaffolding and trestles.

## Introduction

In this unit, you will look at different types of scaffolding and trestles. You will then be able to name and recognise scaffolds and trestles, which will help you to know which one to use for a certain job on the building site. In Units 2 to 5, you will learn what each type of scaffold and trestle is used for.

## Different types of scaffolding and trestles

Scaffolding is a temporary structure that is **erected** to support builders and workers so that they can reach high areas. It also has a platform that builders can stand on. This platform is also useful so that builders can have their equipment nearby.

**Trestles** are scaffolds that consist of **tripod** legs in order to support it.

### Keywords

**Erected** to set up or to put straight up

**Trestles** scaffolds that consist of tripod legs in order to support it

**Tripod** a device with three legs



Figure 3.1 Scaffolding and an extension ladder at a building site



Figures 3.2 to 3.11 show the different types of scaffolding and trestles that can be used in building construction.

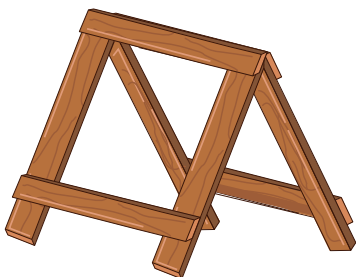


Figure 3.2 A wooden trestle

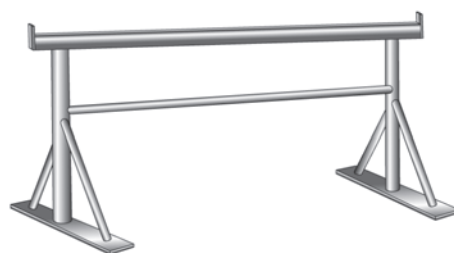


Figure 3.3 A metal trestle



Figure 3.4 A trestle ladder



Figure 3.5 Cantilever scaffolding



Figure 3.6 Trestle scaffolding



Figure 3.7 Tubular scaffolding



Figure 3.8 Mobile scaffolding



Figure 3.9 Modular scaffolding



Figure 3.10 System scaffolding



Figure 3.11 Aerial lifts

### ACTIVITY 3.1

### Types of scaffolds and trestles

1. Name the different types of scaffolds.
2. Name the different types of trestles.

# Unit 2: Trestles

## LEARNING OUTCOMES

- Explain the spacing of trestles.
- Describe how trestle scaffolding is erected.
- Explain the dismantling of trestle scaffolding.

## Introduction

In this unit, you will learn how to correctly space trestles. This is the first part of how to **assemble** and erect trestles, which you will learn about, as well as how to **dismantle** the trestle scaffolding.

### Keywords

**Assemble** to put together, or to join

**Dismantle** to take apart or to break down

**Bandstand** a pavilion or platform you can stand on

## Spacing of trestles

Trestles are scaffolds that are erected using ladders or tripods as the base. A platform is then added to the tripods or ladders to create an area to stand on. Trestles are also called painters' and builders' scaffolds. These scaffolds are used for small building constructions or painting work. There are different types of trestles available.

Builders' trestles are sometimes referred to as **bandstands** or steel trestles. They are manufactured in four different sizes, which you can see in Figures 3.12 to 3.15.



Figure 3.12 A 490 mm to 650 mm trestle

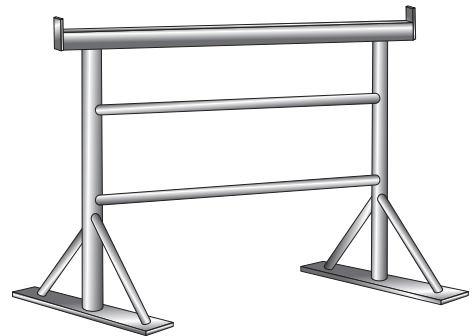


Figure 3.13 A 2 770 mm to 1 200 mm trestle



Figure 3.14 A 1 040 mm to 1 770 mm trestle



Figure 3.15 A 1 320 mm to 2 220 mm trestle

Ladder trestles are also available in different sizes and lengths. The height of ladders ranges from between 1.2 m to 4.8 m. The common lengths of ladders are 1.2 m, 1.8 m, 2.4 m, 3 m, 3.6 m, 4.2 m and 4.8 m. Figures 3.16 to 3.22 show the range of available ladders. Ladders can carry weights of up to 10 kg to 37 kg.



Figure 3.16 A ladder trestle with a height of 1.2 m



Figure 3.17 A ladder trestle with a height of 1.8 m



Figure 3.18 A ladder trestle with a height of 2.4 m



Figure 3.19 A ladder trestle with a height of 3 m



Figure 3.20 A ladder trestle with a height of 3.6 m



Figure 3.21 A ladder trestle with a height of 4.2 m



Figure 3.22 A ladder trestle with a height of 4.8 m

### Keyword

**Mounted** fixed to or attached to something

Some trestles have handrails. The handrail is **mounted** to ensure the safety of the workers and the equipment that is placed on the platform.



Figure 3.23 Trestles with handrails

### Safety tip

Trestles need to be placed between 3 to 4 m apart, depending on the trestle's size and the weight that it needs to carry.

Tripods have three legs, which are used to steady the base of the structure. An example of tripods in use can be seen in Figure 3.24. Sometimes tripods can be ladders with an extra leg added to the structure.

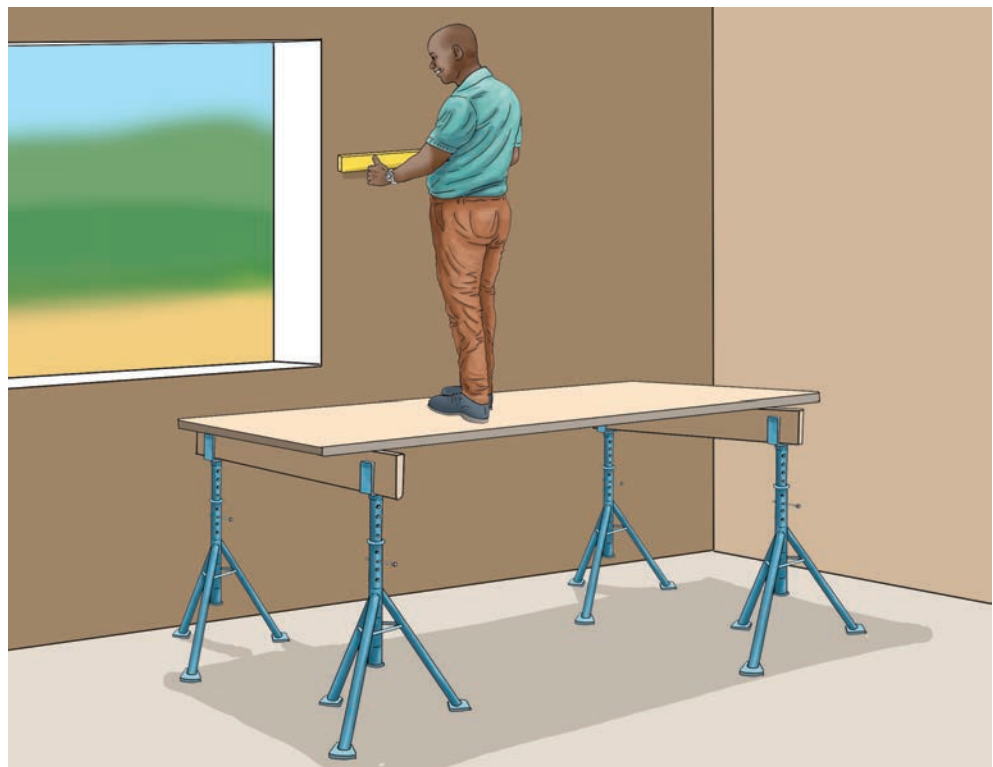


Figure 3.24 Tripods are used to steady the base of the structure.



## Erecting trestle scaffolding

Before you begin to erect trestle scaffolding, a person must be appointed to inspect the safety of the erection according to the OHS Act (Occupational Health and Safety Act) regulations. Then make sure that the area where the scaffold is to be set up has been cleared of all hazards, such as building **rubble**.

Figure 3.25 gives guidelines on the correct measurements and spacing when assembling a wooden trestle. However, it is advisable to get an expert to build it.

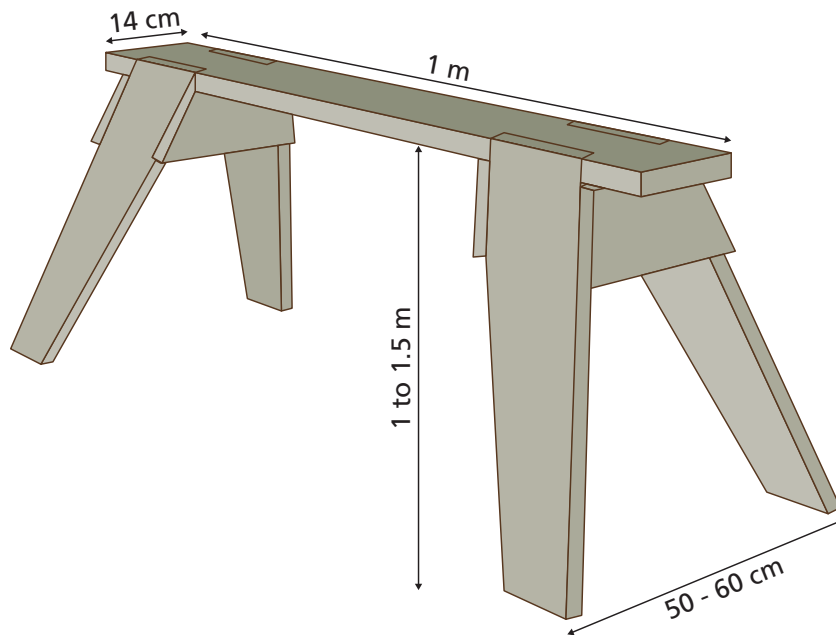


Figure 3.25 An example of a wooden trestle

The **SABS** (South African Bureau of Standards) has the following requirements for erecting trestle scaffolding:

- Wooden trestles must not exceed a height of 1.5 m.
- Steel trestles must not exceed maximum heights of 2.35 m and minimum heights should not be less than 1.30 m.
- The minimum width of the legs when opened and in position must be 780 mm.
- Trestles cannot be used on **slopes** exceeding 1:12.
- The platform on the trestle must be level in all directions within 1:50.

Before you build a trestle scaffold, take note of the following:

- Trestles must be assembled in such a way that they can be folded up for storage and transport.
- A working platform must never be placed more than 2 m high – if it is, provide a guardrail and toe board.
- A maximum height of 2.35 m can only support a typical platform height of 2 m to be managed when the trestle is erected on sloping ground.
- Ensure that the bottom of the trestle is secure on the surface level – if possible, it needs to be mounted to the ground.
- The distance between the horizontal brackets needs to be kept at 2.4 m or less.

### Keyword

**rubble** waste or rough fragments of stone, brick and concrete; usually found on a building site

### Keywords

**SABS** an organisation that regulates the standards and quality of work

**Slopes** ground that is higher at one end than the other

Follow these steps to build a trestle scaffold:

- Step 1:** Open the legs of the tripod, ladder or wooden trestle.
- Step 2:** Ensure that the legs are mounted securely on the ground service or mounted on a base plate, which can be screwed to the ground.
- Step 3:** Then mount the platform or board at the height needed – usually with hooks or screwed onto the trestle.
- Step 4:** Ensure that all parts are tightly fastened together.
- Step 5:** If the trestle is higher than 2 m, add a guardrail and toe board.

## Dismantling trestle scaffolding

Follow these steps to dismantle a trestle scaffold:

- Step 1:** The first thing that you need to take care of is safety.
- Step 2:** Start the process from the top of the scaffold.
- Step 3:** If the guardrails and toe boards were mounted, remove them first.
- Step 4:** Hand over the dismantled part to the person at a lower point.
- Step 5:** Loosen any part of the structure, which might be secured to the building, once that specific height is reached.
- Step 6:** The dismantling process is the same as the building process but it just happens in reverse.

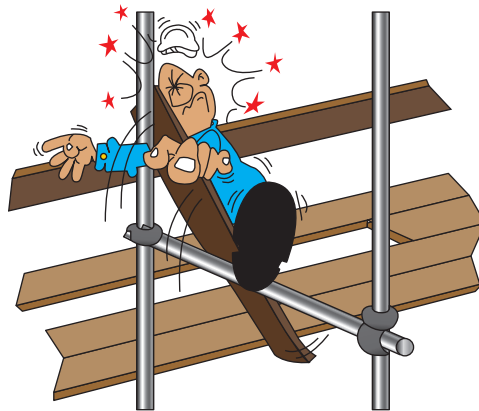


Figure 3.26 Safety is most important when dismantling trestle scaffold.

### PRACTICAL ACTIVITY

### Build a model of a wooden trestle

1. Refer to Figure 3.25 of the wooden trestle. Use matches, or any other material, to create your own trestles.
2. Fix a platform on top of the trestle.
3. When your trestle is complete, it should be strong enough to carry an empty glass or cup.

### ACTIVITY 3.2

### Erecting and dismantling trestles

1. Identify the different sizes of trestles.
2. Give another name for trestle scaffolding.
3. Explain the requirements that the SABS has for erecting trestles.
4. Describe how you would dismantle a trestle scaffold.

# Unit 3: Ladders

## LEARNING OUTCOMES

- Explain how extension ladders are erected.
- Describe and explain extracts from safety regulations.
- Describe correct climbing procedure.
- Explain proper care and storage of ladders.

## Introduction

In this unit, you will learn how to set up an extension ladder. You will discuss the safety regulations for using an extension ladder, as well as describe and discuss the correct climbing procedures. Finally, you will learn how to properly care for ladders and how to store them.

## Erecting extension ladders

Each type of ladder is designed to be suitable for a particular kind of work. The types of ladders that are available are rolling, single, sectional, extension and step ladders. Ladders can be manufactured using wood, metal or fibreglass. Figure 3.27 shows the different parts of an extension ladder.

Extension ladders seem very easy to use but if they are erected in the wrong way they can cause severe injuries.

Here are some guidelines on how to erect an extension ladder:

- Inspect the ladder for any damages or faults.
- Put the ladder in the position that you want it (it must not be extended yet) – it should be at a 4:1 ratio.

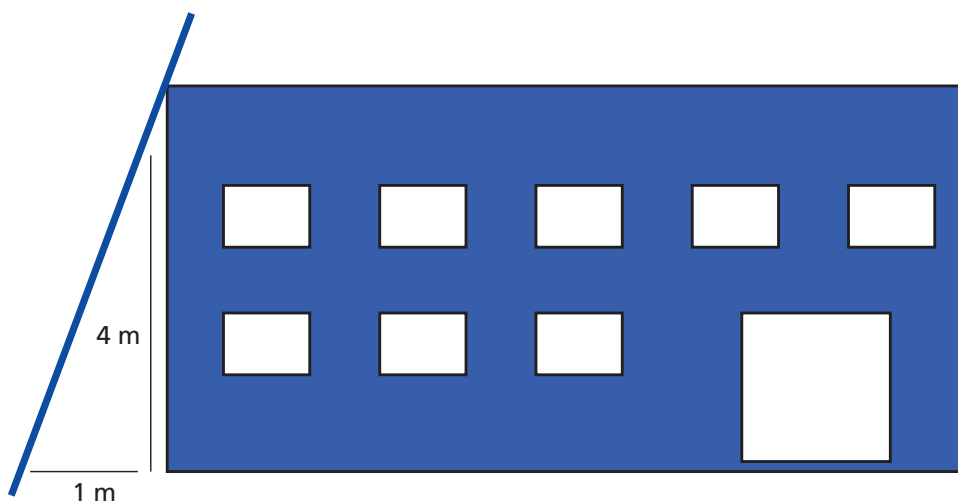


Figure 3.28 Erect an extension ladder at a 4:1 ratio.

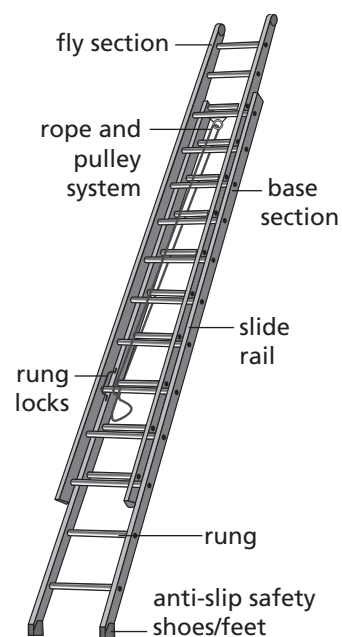


Figure 3.27 Parts of an extension ladder

## Keyword

**Swiveling** rotating or turning

## Safety tip

Only start climbing on the ladder once you feel it is securely on the ground and on the side of the building where you want to work.

- Put the ladder on its anti-slip safety shoe or foot – the **swiveling** rubber ends on the bottom of the ladder.
- Now raise the fly section by either doing it manually or by pulling on the pulley if it has one.
- The ladder must be extended at least  $\pm 1$  m above the working height.
- Ensure that the fly on the rung locks is locked in place to ensure that it stays in position.
- Ensure that the ladder is always secure on its feet, so that it does not move when you climb on it.
- Ensure that both edges at the top of the ladder touch the structure.
- When the ladder is fully raised, secure the top ends of the ladder to the building with a rope or cord.
- If the ladder is not secured or tied at the end, ensure that another person keeps the ladder sturdy at the bottom.

## Safety regulations for extension ladders

There are a number of reasons why people fall off ladders.

- There is not enough supervision.
- No proper training on the correct use has been given.
- A person leans to the sides of the ladder (overreaching) and does not keep their weight in the middle.
- There are no working procedures or the person is not reading instructions.
- The ladder is carelessly handled or not properly positioned.
- A person does not hold on tightly enough to the sides.
- Ladders are broken, poorly maintained or have defects.
- Ladders are used in bad weather, such as in windy weather where the ladder can be blown over or in rainy weather which make the steps slippery.
- Safety regulations are not followed.

In South Africa, there are laws and regulations that are set out for the use and design of ladders.

The SABS has the following set of regulations regarding ladders. They must:

- be made of steel that complies with the SABS regulations
- have handles or stiles that provide a satisfactory grip for workmen who are wearing gloves
- be designed with a width between stiles of at least 310 mm
- have steps or rungs that provide non-slip support when climbing the ladder
- be manufactured with the same stair or rung spacing not exceeding 333 mm centre to centre
- provide a continuous ladder if it is used vertically
- be designed in such a way that it can be specifically used with the type of equipment to which it is fitted.



Figure 3.29 SABS logo





Figure 3.30 OHSA logo

The OHSA (Occupational Health and Safety Act 85 of 1993) has the following requirements when a ladder is being used:

- A ladder must be made out of good materials and must be suitable for the purpose it will be used for.
- Every ladder must be supplied with non-skid devices mounted on the feet of the ladder.
- It must consist of hooks or similar devices at the ends of the rails to keep it stable during usage. If not, it should be lashed, tied or secured when used to ensure stability.
- A ladder may not be used if the sides or rungs are fastened to the steps or stiles with nails, screws or spikes.
- If the ladder is welded together and the sides are riveted or bolted to the steps, the steps need not be let into the rails.
- Ladders must not be used if they are broken, have missing steps or damaged sides.
- Fully extended ladders cannot be joined together to form a longer ladder (longer than 9 m).
- Wooden ladders must not be painted or covered and must be free from any damages or defects.
- Employers must provide suitable means to carry hand tools to the top to prevent falls.

Figure 3.31 shows how safety regulations on an extension ladder have been carried out.

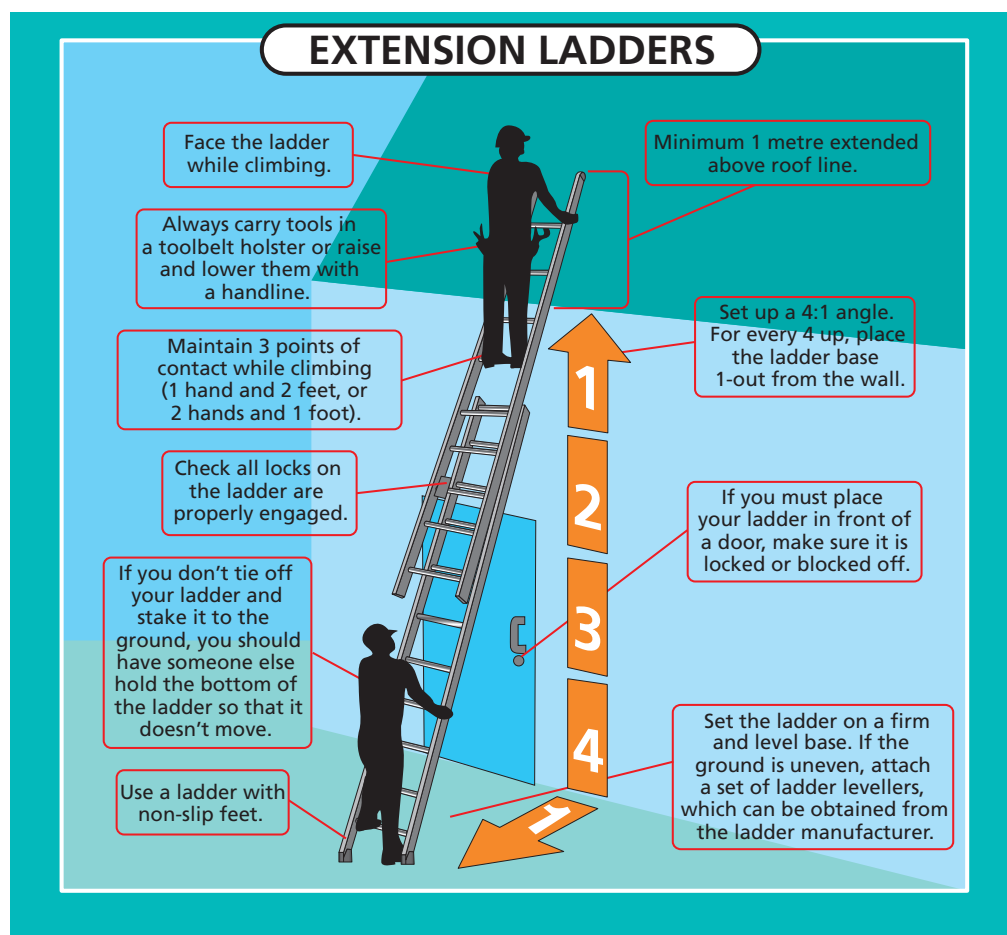


Figure 3.31 How to safely climb an extension ladder

## Correct climbing procedures for extension ladders

There is a correct and an incorrect way to climb a ladder. Figure 3.32 shows you which is the right way and which is the wrong way to climb an extension ladder.

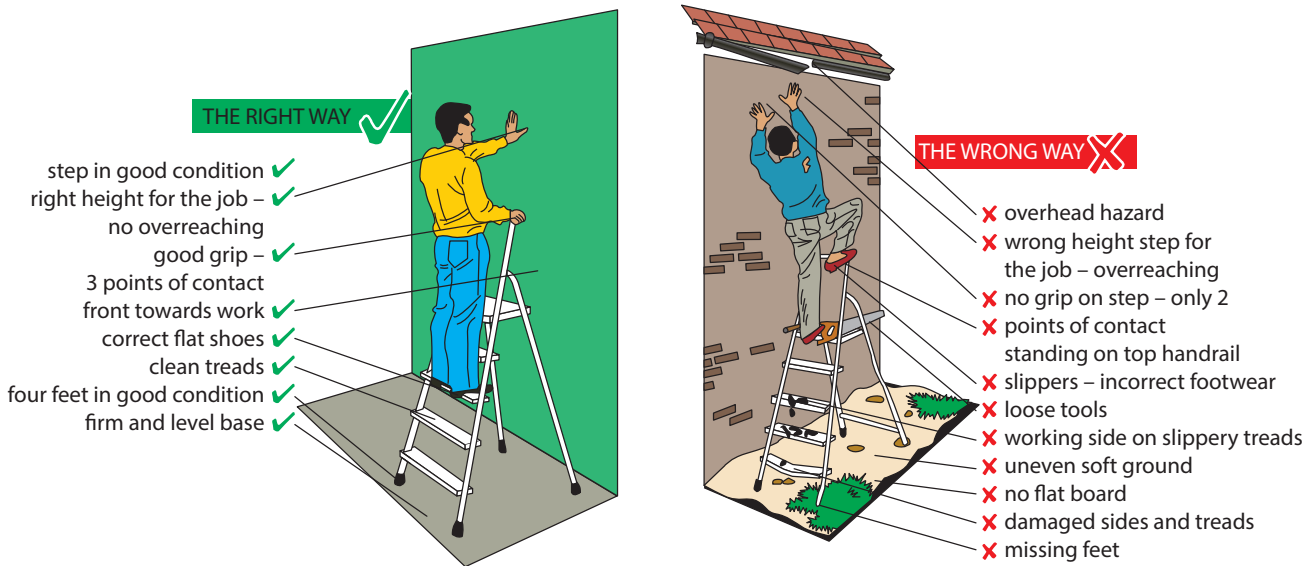


Figure 3.32 The right way and the wrong way to climb an extension ladder

Here are some guidelines to correctly climb a ladder:

- When you climb, take one step at a time.
- Keep both hands securely on the side rail as you climb up the steps.
- Avoid climbing the ladder with tools in your hands.
- Use a tool belt around your waist to carry small tools.
- There should always be three points of contact between the person and the ladder – at least two feet and one hand or two hands and one foot.

### ACTIVITY 3.3

### Extension ladder safety

1. Why do people fall off ladders? Give reasons.
2. Name the guidelines that you can follow to prevent falling off ladders.
3. Describe the regulations set by OHSA for using ladders.
4. Describe the regulations set by SABS for using ladders.
5. What do the abbreviations OHSA and SABS stand for?

## Proper care and storage of extension ladders

Ladders should be inspected by a qualified person who needs to provide a paper certificate to say that the ladders are in a good state to use. The person could complete an inspection document like the one shown in Figure 3.33.

LADDER INSPECTION	LADDER INSPECTION
○ Step ○ Extension No. _____ <b>INSPECT UNIT CAREFULLY BEFORE SIGNING INSPECTION RECORD</b>	<b>NOTES</b>
Yes No <b>STEPS, RUNGS, UPRIGHTS &amp; BRACES</b>	_____
<input type="checkbox"/> <input type="checkbox"/> loose	_____
<input type="checkbox"/> <input type="checkbox"/> loose fasteners or other metal parts	_____
<input type="checkbox"/> <input type="checkbox"/> cracked, broken, split or worn	_____
<input type="checkbox"/> <input type="checkbox"/> splintered	_____
<input type="checkbox"/> <input type="checkbox"/> damaged, worn, non-slip bases	_____
<b>HINGES</b>	_____
<input type="checkbox"/> <input type="checkbox"/> Loose hinge	_____
<input type="checkbox"/> <input type="checkbox"/> Loose, bent spreader	_____
<input type="checkbox"/> <input type="checkbox"/> Spreader stop broken	_____
<b>LOCKS &amp; ROPE</b>	_____
<input type="checkbox"/> <input type="checkbox"/> Loose, broken or missing lock	_____
<input type="checkbox"/> <input type="checkbox"/> Improperly seated when extended	_____
<input type="checkbox"/> <input type="checkbox"/> Worn or rotted rope	_____
<b>GENERAL</b>	_____
<input type="checkbox"/> <input type="checkbox"/> Wobbly	_____
<b>SEE OTHER SIDE</b>	DATE: _____
	BY: _____

Figure 3.33 An example of a ladder inspection certificate

The following information on the ladder should be checked:

- The side rails or stiles must not be bent or split because it could cause the ladder to collapse.
- Make sure that the steps or rungs are not missing, bent or loose.
- The locks and rope must be in proper working condition as they could cause the extension ladder to close when standing on it.
- Make sure that the non-slip feet are still in good condition and can safely grip on the ground.
- If you are using a wooden ladder, it must not be painted, but clear of all grease and dirt.
- Make sure that the ladder is clean and can be erected in a stable position.

There is a correct way to store ladders.

- Make sure that they are easy to reach in the storage space.
- If possible, place them in a vertical position.
- If they are stored horizontally, make sure that there are enough hooks to support the ladder.
- Keep ladders away from the weather so that they do not rust or corrode.
- Keep ladders away from any harmful materials, such as chemicals.

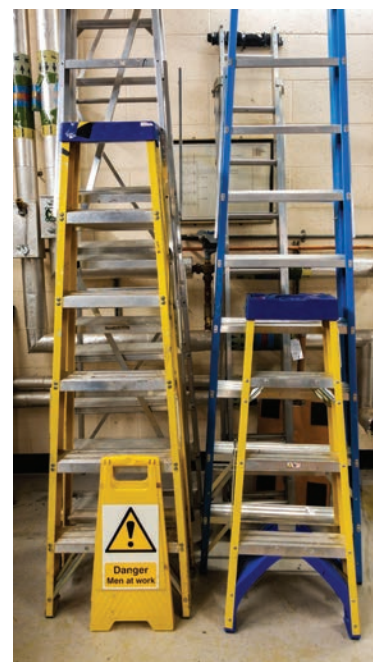


Figure 3.34 These ladders have been correctly stored.

# Unit 4: Step ladders

## LEARNING OUTCOMES

- Describe and explain extracts from safety regulations.
- Describe correct climbing procedure.
- Explain proper care and storage of step ladders.

## Introduction

The rules for using a step ladder are almost the same as for an extension ladder. The only difference is that if you use a step ladder with a lock spreader, the spreader should be fully opened and locked to make sure it is stable.

## Safety regulations for step ladders

Figure 3.35 shows the safety regulations for step ladders.



Figure 3.35 How to safely climb a step ladder

Figure 3.36 shows the incorrect way to climb a step ladder.

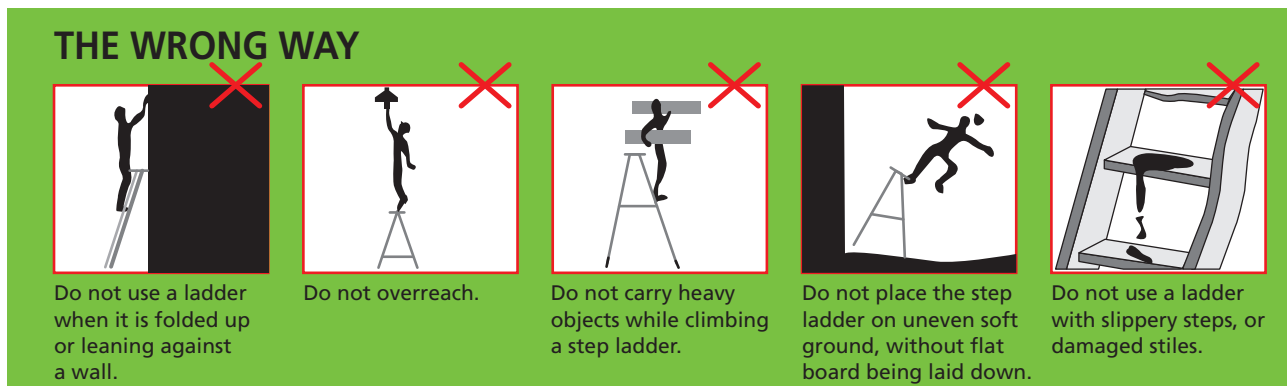


Figure 3.36 The incorrect way to climb a step ladder

## Correct climbing procedure for step ladders

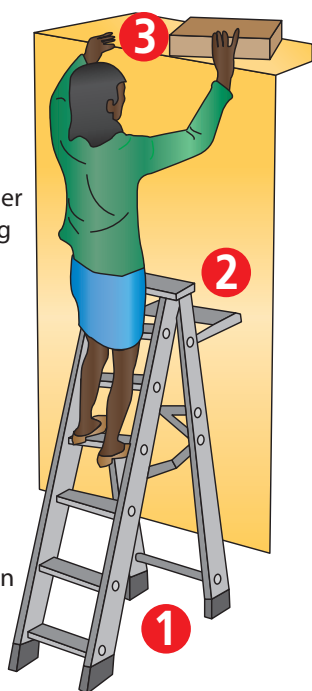
Figure 3.37 gives you a clear 3-step procedure on how to correctly use and climb a stepladder.

### 1 Position the ladder properly.

- Fully open the step ladder on a level surface and lock its sliders in place.
- Never use a step ladder folded up and leaning against a surface.

### 2 Use a ladder that is long enough.

- Never climb on the top two steps of a step ladder.
- Never place the step ladder on boxes or unstable bases to gain extra height.



### 3 Climb and use the ladder carefully.

- Maintain 3-point contact with the ladder while climbing (such as 1 hand and 2 feet). Brace yourself with your free hand, if possible.
- Always face the step ladder treads while using a step ladder.
- Never overreach or lean to one side while using a step ladder.
- Never carry heavy bulky or other objects that may make going up or down a ladder unsafe.

Figure 3.37 A 3-step procedure on how to use and climb a step ladder

## Proper care and storage of step ladders

Follow these steps to correctly store stepladders:

**Step 1:** The storage and care of a stepladder is the same as for an extension ladder.

**Step 2:** Remember never to put any other material or items on top of the platform.

**Step 3:** Never paint a wooden stepladder.

# Unit 5: Metal scaffolding

## LEARNING OUTCOMES

- Define metal scaffolding.
- Name and describe different types of metal scaffolding.

## Introduction

In this unit, you will learn about metal scaffolding and be able to name and discuss the different types of metal scaffolding. You will look at the advantages of scaffolding after a brief introduction to how the scaffolding is assembled. In the practical activities, you will make a model of a wall and in the final activity you will revise all that you have learned about trestles and scaffolds in this module.

## Metal scaffolding

Metal scaffolding is as its name suggests – the material of the scaffolding is manufactured using metals, such as aluminum and steel.

The needs of the industry have changed over the years and buildings have got higher. For this reason, there are different types of scaffolding and trestles that are now being used. You will learn about these different types of metal scaffolding in the following section.

## Different types of metal scaffolding

Let's look at the different types of metal scaffolding.

### Keyword

**Modular** a section or part of a platform that forms the base

## Modular scaffolding

**Modular** scaffolding is when one or more different modules are used to form a base. In some instances, it could be an independent unit as well. This then forms the base and can be constructed to form bigger and more complex modules.

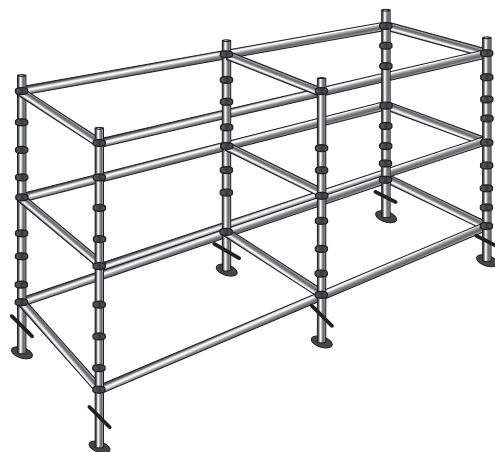


Figure 3.38 Modular scaffolding

These are some advantages of modular scaffolding:

- It is very effective where the area of the building site is complex.
- It can be easily set up wherever it is needed.
- It offers high levels of flexibility.
- It is a basic system, which is not difficult to assemble.

## System scaffolding

This system differs a little from the modular system as it uses rosette connections. Each rosette has eight connections and can align at 90° angles.

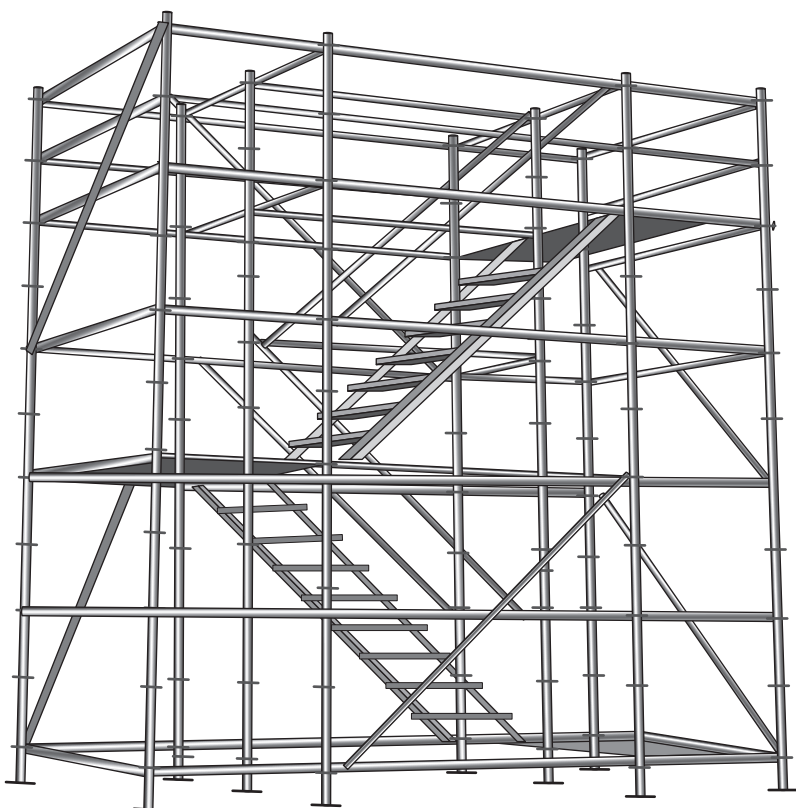


Figure 3.39 System scaffolding using rosette connections

Figure 3.40 shows how the rosette is assembled.

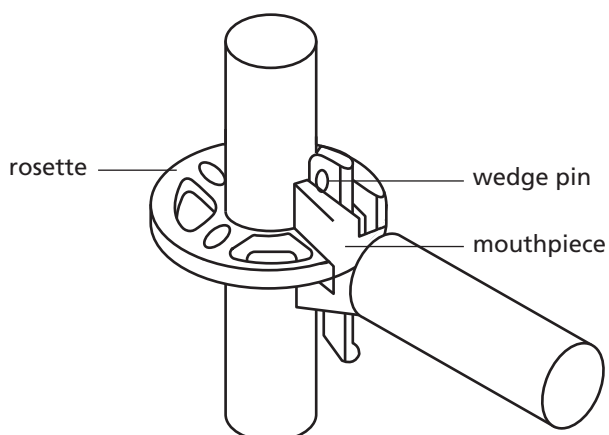


Figure 3.40 How the rosette is assembled

Advantages of system scaffolding include the following:

- Assembly is very easy and quick.
- Quick assembly saves time on construction.
- It is not necessary to use bolts and screws.
- They are efficient and versatile.
- They can be adapted to any angle.
- They are very safe when the connection is secured.

## Tubular scaffolds

This is when scaffold is erected using tubes, couplers and clamps. It is a very traditional system that is still used on many construction sites.

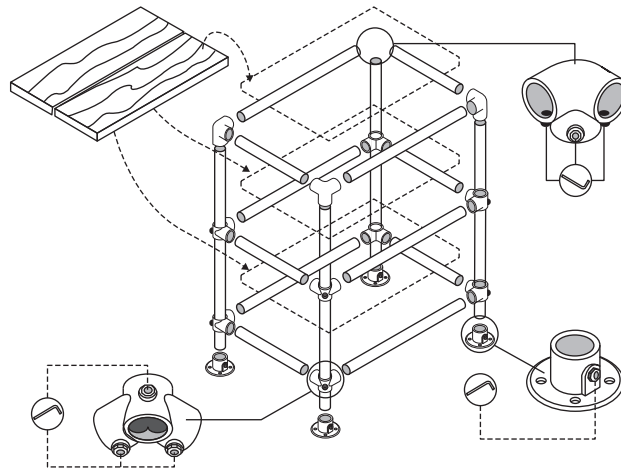


Figure 3.41 Tubular scaffolding

Here are some advantages of tubular scaffolding.

- It provides flexibility.
- It allows for very high construction.
- The structure can be adapted to the circumstances.
- It is very sturdy and safe to use.
- It can accommodate a lot of workers at the same time on different levels.

## Mobile scaffolding

Mobile scaffolding is mounted on wheels. It is especially useful where there is continuous movement of the scaffold on a construction site.

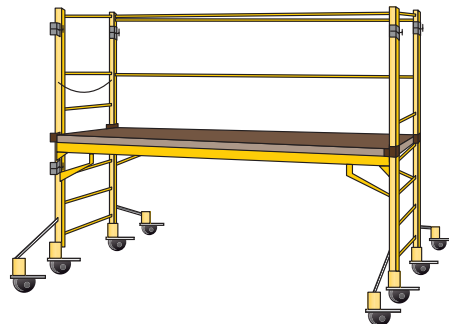


Figure 3.42 Mobile scaffolding



Mobile scaffolding has the following advantages:

- It can easily be moved around.
- It is mounted, with railings around the platform, which increases the safety and security of the worker on the scaffold.
- More than one person can make use of the platform.
- It saves time and increases work output.
- It is user friendly and light weight.

## Trestle scaffolding

Trestle scaffolding is used for light duty work. It is assembled using ladders, or tripods and a platform to stand on.

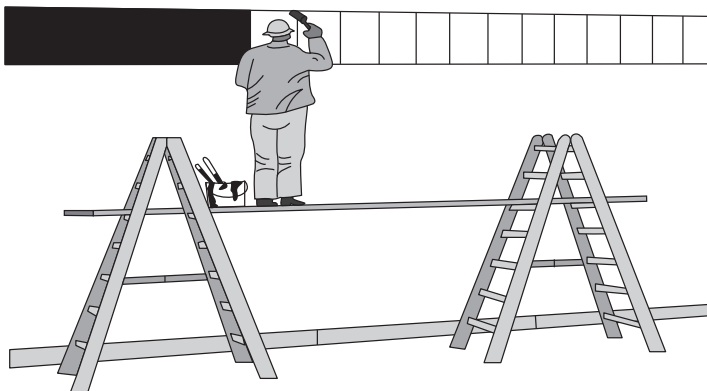


Figure 3.43 Trestle scaffolds

Here are some advantages of trestle scaffolds.

- They are very flexible.
- They are easy to set up and to be dismantled.
- They are easy to move from one part of the site to another.
- If the adjustable legs are used, the height can be increased or decreased according to the situation.

## Single scaffolding

This type of scaffolding is mainly used for brick laying. It is sometimes referred to as brick layers' scaffolding. It is constructed with base plates, **ledgers** and **putlogs**. The structure is sometimes mounted to the wall that is being built and fastened with the putlogs on the other end of the wall.

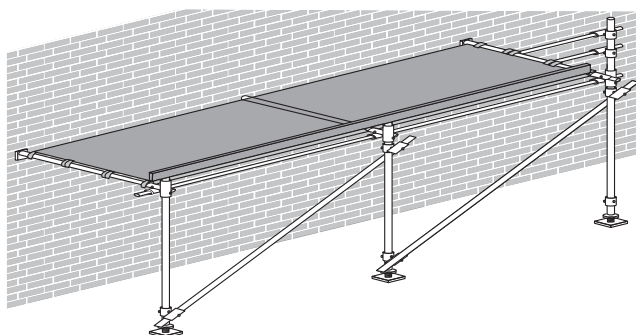


Figure 3.44 Single scaffolding

### Keyword

**Ledgers** the horizontal tubes that run parallel to the building and are fixed to the standards (vertical tubes)

**Putlog** small holes made in the walls of structures to receive the ends of poles or beams

## Keyword

**Cantilever** a beam that projects outwards and is supported at one end

Single scaffolds have the following advantages:

- They use the wall that is being built as support.
- The structure is sturdy and safe.
- It is simple and easy to set up.
- They use less components compared to other structures.

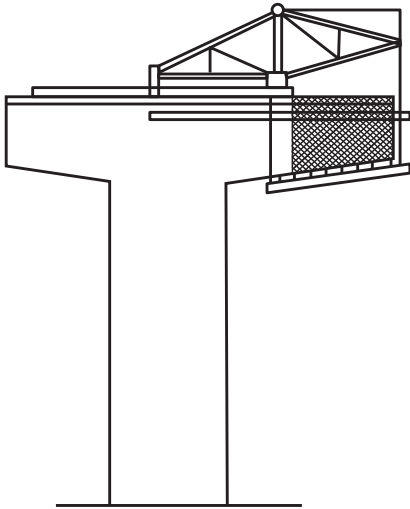


Figure 3.45 Cantilever scaffolding

## Cantilever scaffolding

A **cantilever** scaffold is mounted onto the wall with pins. It is also sometimes called pins scaffold. This type of structure is very useful where there is no space on the ground area to erect a scaffold.

Here are some advantages of cantilever scaffolds.

- They can be mounted, especially if the ground area is not suitable for a scaffold.
- They protrude, or hang over a street or other small building, without hindering other construction business.
- The walls and pillars can be used as support.
- They are really safe and can accommodate a lot of workers at the same time.
- They can be erected to reach heights that other scaffolds will not be able to reach.

## Aerial lifts

Aerial lifts are machine-operated lifts that elevate the platform to the desired heights. They are very useful for maintenance and small repair jobs.

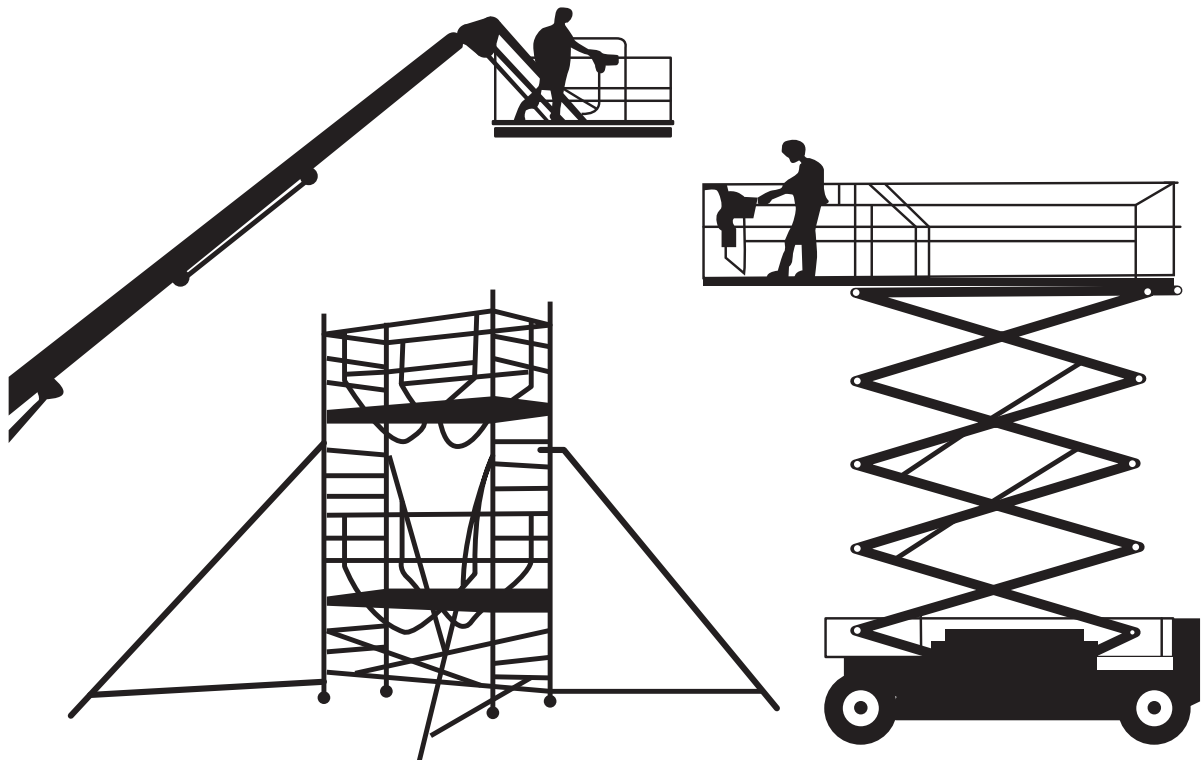


Figure 3.46 Aerial lifts

Aerial lifts have many advantages.

- They can easily reach hard-to-reach places.
- They are mobile and can move quickly and easily to any area on the site.
- They are very simple and safe.
- They do not need a lot of area space.
- They do not need to be erected or dismantled.

### PRACTICAL ACTIVITY

### Build a model of a wall

This can be a group or individual activity.

Use any recycled material to make this model.

1. a) Make a wall using match boxes. Use the matches or any other sticks that you can find to create your own scaffolding.
  - b) Make sure that there are connections between the matches, glue, wire or any connective material.
  - c) Make sure that there is a platform.
  - d) Make provision for safety.
2. When the model is complete, the group or student should explain their design to the class, as well as the advantages of their design.

### ACTIVITY 3.5

### Revision of scaffolds and trestles

1. Name the different types of scaffolds?
2. What is scaffolding?
3. What is a trestle scaffold?
4. Name the advantages of an aerial lift.
5. Describe how a cantilever scaffold is assembled.

## Module summary

- Scaffolding is a temporary structure that is erected to support builders and workers so that they can reach high areas. It also has a platform that builders can stand on.
- Trestles are scaffolds that are erected using ladders or tripods as the base. A platform is then added to the tripods or ladders to create an area to stand on.
- Builders' trestles are sometimes referred to as a bandstand or steel trestle.
- Ladder trestles are also available in different sizes and lengths. The height of ladders ranges from between 1.2 m to 4.8 m. The common length of ladders are 1.2 m, 1.8 m, 2.4 m, 3 m, 3.6 m, 4.2 m and 4.8 m.
- The different types of trestles include wooden trestles, metal trestles and trestle ladders.
- The different types of metal scaffolds include modular scaffolding, system scaffolding, tubular scaffolding, mobile scaffolding, trestle scaffolding, cantilever scaffolding and aerial lifts.
- Follow SABS regulations to erect a trestle scaffold.

