Structural Construction Works

Level-II

Based on March 2021, Curriculum Version 1

Module Title: - Constructing and Install Floor Frames, Planks and Sheets

Module code: EIS SCW2 M10 0322

Nominal duration: 60Hour

Prepared by: Ministry of Labor and Skill

October 2022

Addis Ababa, Ethiopia

Contents

Acknowledgment

Ministry of Labor and Skills and Regional TVT Bureau wish to extend thanks and appreciation to the many representatives of TVT instructors and respective Ministry of Labor and Skills experts who donated their time and experience to the development of this Teaching, Training and Learning Materials (TTLM).

Acronym

EMP .....Environment Management Plan

EPA .....Environmental Protection Agency

IRC.....International Residential Code

OSHA.....Occupational Safety and Health Administration

PPE**.....**Personal protective equipment

TTLM..... Teaching, Training and Learning Materials

TVT.....Technical and vocational Training

Introduction to the Module

This Module specifies the competence required to construct and install wooden floor-frames to carry the planks, sheets and the base load. This module also includes processing the planks and sheets to cover the sub-structure.

This module covers the units:

- Plan and prepare
- Set out sub-floor frame
- Install timber bearers
- Install timber floor joists
- Install flooring
- Clean up

Learning Objective of the Module

- Plan and prepare
- Perform Set out sub-floor frame
- Install timber bearers
- Install timber floor joists
- Install flooring

Module Instruction

For effective use this modules trainees are expected to follow the following module instruction:

1.Read the information written in each unit

2.Accomplish the Self-checks at the end of each unit

3.Perform Operation Sheets which were provided at the end of units

4.Do the "LAP test" giver at the end of each unit and

5.Read the identified reference book for Examples and exercise

Unit one: Plan and prepare

This unit is developed to provide you the necessary information regarding the following content coverage and topics:

- work instruction
- Safety requirements.
- Select tools and equipment
- Calculate quantity of material
- environmental protection requirements

This unit will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Obtaining and confirming work instruction
- Apply and Follow safety requirements.
- Selecting tools and equipment
- Calculate quantity of material
- Identify environmental protection requirements

1.1. Work Instruction

This publication provides a reference guide for the installation of solid timber strip flooring over bearers and joists, timber-based sheet flooring products and concrete slabs. Generally, floors of this type are of solid timber or a laminated product made from layers of timber bonded together. Flooring fits together with a tongue and groove joint. After the flooring is in place, the floor is sanded and finished.

There are a number of other timber flooring products that are not of this type and are not covered by this guide. These include parquetry, prefinished floors and 'floating' timber floor systems. When installing a strip timber floor, many aspects must be considered, including the house design, environment in which the floor is to be laid and the desired appearance of the finished floor. Such aspects influence the choice of species, cover width, fixings and finish to be applied. Information relating to product selection, assessing the installation environment, floor installation, sanding and finishing are provided in the guide, together with additional information of importance to the floor installer, sander and finisher.

A document describing specific activities and tasks within the organization. It contains the greatest amount of detail. As a component of a process, "defines how one or more activities in a procedure should be executed in detail, using technology or other resources. Here are some examples of documented work instructions which may be found on a typical construction site:

- ✓ Specifications/Contract specifications
- ✓ Construction method statements
- ✓ Quality requirements
- ✓ Operational details
- ✓ Maintenance manuals

Floor is the bottom surface of a room or vehicle. Flooring is the general term for a permanent covering of a floor, or for the work of installing such a floor covering. A lot of variety exists in flooring and there are different types of floors due to the fact that it is the first thing that catches your eye when you walk into a house, as it spans across the length and breadth of the house. It is also the surface that goes through the most wear and tear, and that's why choosing the right material is of utmost importance.

❖ **The Flooring Process**

Strip timber flooring is available in a wide range of species and colors, from harder and softer timbers and a variety of profiles and cover widths. Prior to the finished floor being handed over, there are a number of processes that must be correctly undertaken to achieve a floor with the performance and appearance that is of a professional standard. Each stage generally involves different sectors of the industry, each having specific skills. Each stage is of equal importance, with defined responsibilities.

A lack of attention at any particular stage can adversely affect the finished floor. The stages are as follows:

i. Manufacture – Usually carried out by a saw miller, however, dried rough sawn boards may be machined into finished floor boards undertaken by a separate operation.
ii. Distribution – Flooring is often sold to timber merchants who on-sell to the installer.
iii. Specification – Architects, designers and owners usually specify the product to be installed.
iv. Sub-floor – Builders provide the joists and bearers or slab over which a floor is laid.
v. Installation – Specialist floor installers and carpenters install floors over the sub-floor.
vi. Sanding and Finishing – Generally undertaken by professional floor sanders and finishers.

1.2. Safety Requirements.

Construction industry, often termed as ‘high-risk’, has a significant impact on the health and safety of the workers. Though it is common to see a construction worker work at heights with equipment and building materials, these scenarios are plagued by potentially dangerous situations and poor working conditions. They are exposed to hazards that are difficult to quantify. Different job sites have different procedures and conditions – identifying the source(s) that poses challenges to Occupational Health and safety (OHS) of the workforce remains critical.

Safety is an attitude, a form of mind of worker. If the attitude of worker towards safety is good and he is safety conscious, then he himself will develop the safe working habits.

- Safety is the first essential requirement and every personnel must learn the safety measures even before starts any work
- Before you can use equipment and tools or attempt practical work in a site/workshop you must understand basic safety rules. These rules will help keep you and others safe in the site/workshop.
- Safety is a precaution to avoid accident.
- Care is a technique of properly handling tools, equipment & materials.

❖ **Functional Safety Requirements**

✓ Required safety functions to achieve functional safety
✓ Application of safety functions as protection (low demand) and/or continuous control
✓ All applicable modes of operation of EUC—normal and under failure
✓ Failure behavior and expected response
✓ Hardware and software interface and constraints
✓ Environmental conditions related with safety functions
✓ Operator interface and communication
✓ Response time and throughput
✓ Interface with non-PE systems for achievement of safety function
✓ Periodic testing interval

❖ **General Safety Rule**

One of the most hazardous jobs in carpentry is erecting a roof. The carpenter must work at the highest point of the building, lift heavy members, and then nail them in place, often in an awkward position.

✓ Preventing accidental falling of workman during the construction of roofs should be ensured by providing plat form, catch ropes, etc.
✓ Precaution while using different type's hoists must be taken.
✓ Stand at the right position to be free.
✓ While hauling the trusses to their final position of the roof, no workman should be allowed to ride on them.
✓ Precaution by way of guide ropes, guides should be provided to prevent under swinging of trusses while lifting.

- ✓ Ones in position the trusses should be kept secured with the adequate temporary measures till the final fixing is carried out.
- ✓ Temporary flooring or planks should be installed and fastened where necessary to produce safe footing.
- ✓ Learn to use the tools correctly-Understanding using of hand tools in proper ways.
- ✓ Don't fool around

❖ **What is Workplace Safety**

Workplace safety is a composite field related to safety, health and welfare of people at work. It narrates the strategy and methods in place to ensure health and safety of employees within a workplace. Workplace safety includes employee awareness related to the knowledge of basic safety, workplace hazards, and risks relating to hazards, implementation of hazard preventions, and putting into practice necessary safer methods, techniques, process, and safety culture in the workplace. It also includes safety rules and regulations designed mostly on the basis of existing government policies. Every organization puts in place a number of safety rules and regulations for its people. Safety training and education for employees is imparted periodically with a view to making them aware about and updating them with latest safety measures.

Workplace safety is about putting a stop to injury and sickness to employees in the workplace. Therefore, it is about safeguarding assets and health and life of the employees. It also features in cutting down the cost of lost-work hours, time spent in putting short-term help and the schedule and services that may fall off due to less of service providers, pressure on those providers who are selecting the absent employees portion or poor case, having to shut out or shut down a program due to lack of providers.

❖ **Need for Workplace Safety**

Before analyzing various aspects of workplace safety, it is pertinent to know the reasons for ensuring safety in life. We attach top priority to safety and security in places we live, stay, visit or work in. To Say no to Accidents − Accidents are fallouts of carelessness and lack of responsibility. When we don't follow required safety norms we end up in getting injured or even in ending our valuable lives. It is true with regard to our home and workplace alike.

- ➢ **To Stay Healthy and Energetic** − we should have a healthy food habit, which is itself a safety measure, to keep us healthy and lively for work at home and in workplaces.

- **To have Longevity in Life** − we should take care of ourselves everywhere we are and of others for leading a safe and meaningful life.
- **To create Public Awareness** − Promotion of safety norms everywhere creates public awareness and discipline. It is true of workplaces and motivates new employees to take up safety measures necessary for their safety.
- **To avoid loss of Property and Life** − the basic aim of safety measures is to prevent the occurrences of mishaps and hazards that sometimes cause heavy loss of life and property.
- **To Devise Planning for Safety** − Need for safety paves the way for devising an effective planning for all-round safety of employees in an organization.

❖ **Basic Objectives of Workplace Safety**

The basic objectives of workplace safety are as follows −

- Preservation of and assistance for employees' or workers' health and well-being
- Enhancing workability of employees by ensuring a safe and congenial work environment
- Growth of the organization that remains free from prospective hazards and mishaps
- Encouraging a favorable social climate in the organization that motivates the employees to work efficiently towards organizational progress and prosperity
- Secure the health and safety of workers and workplace by eliminating or minimizing risks
- Achieve higher productivity among the employees by providing a safe and secure environment
- Focus on employees' safety and health arising from chemicals and hazardous elements used at workplaces.

❖ **Rules for workplace safety**

Everyone has a role in making sure a workplace is safe, from the administrative assistant who gets the boxes of newly delivered office supplies unpacked promptly to the warehouse foreman who makes sure every person on the line gets a break. When you take charge of your own safety, it creates a safer place for all employees.

1.Dress appropriately, from clothing to footwear.

Keeping arms and legs covered, avoiding dangling jewelry or ties, and wearing closed-toe shoes can go a long way in minimizing common workplace injuries and accidents. When and where

applicable, always wear **personal protective equipment (PPE)**, and inspect it for damage before and after use, so that it can be repaired or replaced promptly.

2.Keep work areas neat and tidy.

At the beginning and end of each shift, clear away trash, pick up cords and cables, and put office supplies away. Gather any materials you'll need to complete your work. This will avoid losing things as well as having to bend or stretch unnecessarily, trying to reach objects that are misplaced or out of reach.

3.Follow the rules.

Don't cut corners or take unnecessary risks.Workplace safety rules are often developed in response to hazard and risk assessments. They are by nature designed to minimize the chances that an employee will be injured while carrying out assigned tasks.

4.Report workplace accidents or safety incidents.

Always report incidents to your supervisor promptly so that the appropriate steps can be taken. These can include getting care for an injured employee, fixing the problem that caused the injury, or ensuring regulatory, state or federal reporting compliance.

5.Know and follow emergency procedures.

In order to safely and effectively manage emergencies, it's imperative that all employees are trained in and follow emergency procedures. This helps safety coordinators and emergency services get a handle on a situation and determine the best way to bring it under control.

6.Lift, bend, and stretch with care to avoid injury.

Musculoskeletal problems caused by poor technique when picking up boxes or stretching to reach objects is a common cause of workplace injury. If you're not sure how to best lift, bend or stretch at work, ask your supervisor or company safety officer.

7.Don't operate tools or machinery that you haven't been trained for.

While some tools or equipment may seem pretty intuitive, it's always best to avoid using items unless you've been trained in **proper handling**. This is for your safety as well as the safety of those around you.

9. **Avoid drugs and alcohol at work.**

Not only can drugs and alcohol affect your motor skills, they can also impair your judgment and ability to communicate. Even prescription drugs can have a serious effect on your ability to handle machinery and tools safely.

8.Take breaks appropriately.

Being well-rested helps employees maintain the focus and situational safety awareness that contribute to workplace safety. In some places, work breaks may be established according to contract; in others, it's on the employees to work out breaks among themselves.

- **Personal Safety**

It is dangerous to work with sharp edge tools and talk at the same time. Be agreeable with your neighbor workman. Respect his right and privileges. Remembering accidents prevented today will help make a living tomorrow. Some safety procedures should be followed at all times. Pay close attention to what is being done.

The primary important to protect the workman from accidents is to identify possible hazards and take the necessary safety measures to eliminate the hazardous. Before you go to work on any job, make sure your entire body is properly protected and provided other personal protective equipment.

Safety elements or hard hats should be wear by workers in all construction site where they might be exposed to head injury from falling objects.

- **Safety equipment**

a. Helmet

Protects the carrier from down falling items. It should be a must for everybody who works or moves on a building site.

Figure 1.1Helmet

b. Ear protection

Protects the carrier from damages of the ears. Continuously working in a very noisy environment harms the eardrums forever. Once the eardrums are damaged there is no way of restoring the sense of hearing again.

Figure1.2 Helmet

c.Safety shoes

Safety boots are equipped with three safety measures. It must have:

1. Toes protection hood
2. A steel hood to protect the toes from down falling heavy thing
3. A steel layer inside the soles protects the carrier from stepping into a turned up nail.
4. Benzene and oil resistant soles

Figure1.3 Safety shoes

d. Safety goggles

Necessary during chiseling and grinding work protects against chips sparking around from the work piece.

Figure 1.4 Safety goggles

e. **Wearing clothes**

These are generally worn as a means of protecting. Such protective clothing should be changed and washed quickly and is best kept in a locker or store at the place of work.

Figure 1.5Wearing Safety clothes

❖ **Causes of Accidents**

The accidents may take place due to human causes, environmental causes and mechanical causes. These causes are discussed as under.

I. Human Causes

1. Unsafe or dangerous equipment rotating, reciprocating and moving parts.
2. Operating machines without knowledge, without safety precautions, without authority, without safety devices.
3. Accidents generally occur while operating or working at unsafe speed.
4. Accidents may occur while working for long duration of work, shift duty etc.

5. Accidents may occur while working with mental worries ignorance, carelessness, tension, dreaming etc.

6. Accidents occur because of not using personal protective equipment.

II.Environmental Causes

1. Accidents may occur during working at improper temperature and humidity causes fatigue to the workers so chances of accidents increases with workers having fatigue.

2. The presence of dust fumes and smoke in the working area may causes accidents.

3. Poor housekeeping, congestion, blocked exits;

4. Accidents occur due to not enough light.

5. Improper ventilation in the plant may also leads to industrial accidents.

III. Mechanical Causes

1. Use by old, poor maintained or unsafe equipment may result in accidents.

2. Use of unguarded or improper guarded machines or equipment.

3. Unsafe processes, unsafe design and unsafe construction of building structure may lead to accidents in the place.

4. Accidents occur due to improper material handling system and improper plant layout.

5. Accidents may occur due to not using of safety devices such as helmets, goggles, gloves, masks etc.

1.3. Select Tools and Equipment

There are several type tools used by a construction. Hand tools, in general, ease the work and accelerates the process, improves quality of work significantly and they are very important for everybody who wants to do decent work so that keep tools in perfect order. In addition tools and equipment also represents highly valued assets. For this reasons it is crucial necessary to handle tools and equipment with extra care. That means cleaning after use, storing neatly, slightly greasing if necessary and regular maintenance.

I. Tools

❖ **Tools Needed by Flooring**

Find the type of flooring you're installing below and use our checklist to make sure you're prepared. Whatever type of flooring you're installing, you should always have proper safety protection including glasses, gloves and kneepads for comfort.

❖ **Vinyl & linoleum**

- Adhesive trowel
- Flat bar
- Straight edge
- Floor scraper
- Level
- Tape measure
- Chalk line
- Floor roller
- Utility knife / linoleum cutter

Floating wood

- Chop / miter saw
- Floor scraper or flat bar
- Tapping block
- Tape measure
- Pull bar
- Level
- Rubber mallet
- Chalk line
- Spacers
- Jig saw

Traditional wood

- Pneumatic flooring mailer
- Air compressor
- Nail set
- Drill
- Drill bits
- Chop saw
- Chalk line
- Table saw

Ceramic tile

- Level
- Sponges
- Notched trowel
- Buckets
- Wet saw
- Spacers
- Nippers
- Tile saw / score n snap cutter
- Grout float
- Chalk line
- Tape measure

Saw stools

- Planks for scaffolds
- Check batteries for battery operated tools
- Laser levels or automatic levels

❖ **When selecting tools for the task consider the following:**

- Are the required tools or tooling available onsite?

- Is the tool the correct tool and appropriate to the task.
- Is the tool suited to the site conditions:

1.3.1. Measuring and marking tools

Measuring Hand tools and instruments are precise devices but needed to be handled with extra care.

i. Spirit level

It is used to control the horizontal and vertical alignment of wall surface and edges. The length is at least 80 to 120cm long. It is made of metal, synthetic material or wood. It has two measuring bubbles: one is located at mid length is used to check horizontal positions. While the second one, at the end, is used to check vertical position. This tool requires always to be handled with care and needs to be checked from time to time weather it is still working accurate or not.

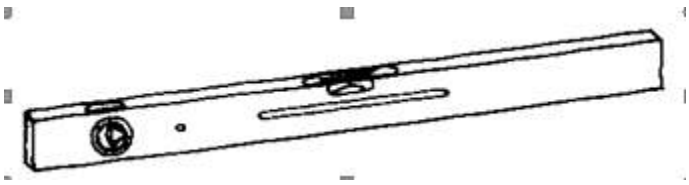


Figure1.6 Spirit level

ii. Plumb bob

A plum bob is made of metal. When suspended from a vertically attached string, it is employed to check the vertical alignment of corners and surface of walls. A freely hanging plumb bob

Figure1.7 Plumb bob

iii. Graphite Pencil

This is used for marking in wall construction. It is specially produced for this purpose in such a way that it will not wear out fast.

iv. Folding meter

For measuring length in wall construction, it is convenient to use rigid scales. Such a measuring scale/ folding rule/ is made of 20cm separate wooden pieces joined together by pins. The scale has subdivisions in cm and mm.

Figure1.8 folding meter

v. **Angle / Try square**

It is used to measure a right angle (90º) of a corner. Used in laying masonry units or blocks at corners of masonry wall.

vii.Measuring tape

Tape is used to measure dimensions of building parts and distances in site. It is manufactured from steel, plastic or fibre in lengths of 1m, 2m, 3m, 5m, 30m, etc.

viii. Hose level

It is a transparent PVC hose. It is used to transfer or mark vertical levels on surface of wall when it is filled with water, but without any air bubbles.

Figure1.9 Hose level

- **Cutting tools**

On the construction site, the workman uses a number of different saws. These saws are designed for specific types of work. Many are misused. They will still do the job, but they would do a better job if used properly. Most of these saws are used with a push motion in contrast.

- **Ripsaw**:

It is used for sawing with the grain or fiber of the wood. The tooth is chisel shaped are set alternately to the right and left.

- **Coping saw:**

It Is used to make small irregular curved cut.

- **Backsaw:**

It is a cross cut saw with a thin blade and fine teeth. A heavy piece of steel fitter over the back of the thin blade. Prevents it from buckling. The blades of backsaw are from 20cm to 45cm long. It is designed for fine accurate work.

- **Hacksaw:**

The hack saw form is used with a variety of interchangeable metal cutting blades, which are used, for cutting soft metals and hard metals such as nails, angle Iron and reinforced steel.

- **Bow saw:**

Carpenters usually use Bow saw in the construction site in order to cut like eucalyptus wood. The upper section to the tension arm should be provided with an eye for easy opening and should be designed to support the hand; supplied blade of hardened tooth points.

Figure 1.10 Bow saw

II. Equipment's

A. Band saw

Band saws are the best ways sawmills can use machine driven force to cut logs in any diameter possible. Commercial mills have built their own band saws that can cut logs almost 6′ in diameter. This is a great process for cutting 'chunks' or beams of wood (from the same section of the tree) that will be manufactured into the boards that will eventually become hardwood flooring. Band saw can also get veneers, but the accuracy is not as good as the frame saw.

Figure1.11 Band saw

B. Frame saw:

Frame saw is used to take the blocks of wood created from the band saw and produce veneers, or slats, from them. The frame saw is used instead of the band saw for a couple reasons

Figure 1.12Frame saw

C. Table saws

Table saws are one of the workhorses of any workshop or garage. Table saws are very simple, a circular saw blade is spun at high speeds at a stationary position and the operator pushes the wood into the blade. There is some room for customizability, especially with regards to the blade, which can be changed to accommodate different kinds of jobs.

Figure1.13 Table saws

D. Circular saws

A circular saw is a versatile tool that offers high portability. The main purpose of a circular saw is to cut wood and other soft materials; in this sense, they are essentially portable table saws. You can also this saw to cut tough materials like metal with the appropriate circular saw blade. The working principle of a circular saw is opposite of a table saw. How Circular Saw works: A circular saw it a handheld power tool with a rotating blade that is pushed across the

work piece to cut through it. That means the work needs to be stationary and the rotating circular saw blade moves to make the cut.

Figure1.14 circular saw

E. Miter saws

Miter saws are a more specialized kind of saw but despite this, they are fairly common, especially in professional workshops. A Miter saw, as the name implies, is designed to make one specific kind of cut, miter cuts. Miter cuts are cuts made at any angle other than 90-degrees along the length of the width of the wood. Don't get me wrong; miter saws can make crosscuts (90-degree cuts) perfectly fine.

Figure 1.15Miter saws

How Miter Saw works: A large revolving circular saw blade that is fixed on a swing arm is brought on to the work piece which is fixed on the miter saw table to perform the cutting action. The work piece is held against the miter saw fence to make sure that they are square to the miter saw blade.

F. Jigsaws

Jigsaws work similarly to reciprocating saws, except with two key differences. Firstly, unlike with regular reciprocating saws, the blade on a jigsaw aims downward, instead of jutting out from the nose of the saw. Secondly, jigsaws are designed specifically to make curved or otherwise non-straight cuts.

Figure 1.16 jigsaws

G. Track Saws

Track saws are essentially circular saws, but with an added metal track attached. The metal track is designed to enhance the accuracy and stability of the saw.

Figure 1.17Track Saws

H. Pneumatic Tools

Compared to many other energy sources, compressed air is one of the most convenient and powerful to use with many different tools. The use of air tools is long and varied, and the benefits often far outperform compatible products. Air tools generally offer.

Figure 1.18 Pneumatic Tools

H. Hot Press and cold press

The internal construction of an engineered wood flooring plank includes anywhere from 3 to 12 or more layers of plywood installed in a cross-hatch method. The plywood is more dimensionally stable so that engineered wood won't absorb or excuse moisture as the air in the room fluctuates. These layers of plywood are installed by using a hot press to create an almost impenetrable layer of glue and wood on the engineered wood floor core. The top layer of manufacturing applies the veneer top which gives the floor its distinguished looks to the engineered core that provides its stability. Gluing with a cold press is a less-invasive process that won't damage the color or texture of the veneer.

I. Sanding machine:

A sanding machine helps make sure the boards in a batch of engineered wood flooring are the same thickness. The planks are sent through the sanding machine and calibrated to tight tolerances so that the planks lay evenly when installed.

Figure 1.19 Sanding machine

J. Acquire coating line

Flooring is under an extreme duress from foot traffic, pets, moving furniture, etc. The lacquer coating top layer(s) represent the first line of defense to protect the wood and other coating processes set up a barrier for the wood itself.

1.4. Calculate Quantity of Material

This floor joist calculator will help you when you buy floor joists for your next flooring or deck framing project. Using this tool, you can quickly find out how many floor joists you will need for any size of floor and joist spacing. You can also estimate the material cost you'll need to set aside, since this tool also works as a floor joist cost calculator. This tool is also a floor joist span calculator (which you can use separately) to determine the maximum allowable span a floor joist can have.

For the calculation purpose, let us consider a room of size 12M. ×15M.

To calculate the number of tiles needed for this room, first, we will calculate the area of this room.

Room area = L × B = 12M× 15 M. = 180 sq.M

Now, we will consider floor tile of size = 30cm × 30cm

Area of one tile = l × b

= 30cm × 30cm

= 900 sq.cm.

Since the area calculated for the room is in sq.M., first we will convert the area of one tile into the same unit i.e. into sq. M.

As you know, 1 sq. M. = 10000 sq.cm.

Area of one tile in sq.M.

= 900 ÷ 10000

= 0.909 sq.M.

Same unit i.e. into sq. M.

As you know, 1 sq M. = 10000 sq.cm.

Area of one tile in sqft

= 900 ÷ 10000

= 0.909 sq.M.

Now the number of tiles needed

= area of room ÷ area of one tile.

= 180 sq.M ÷ 0.909 sq.M

=198.01 say 199 nos

Now let us calculate the no. of tile boxes needed for this room.

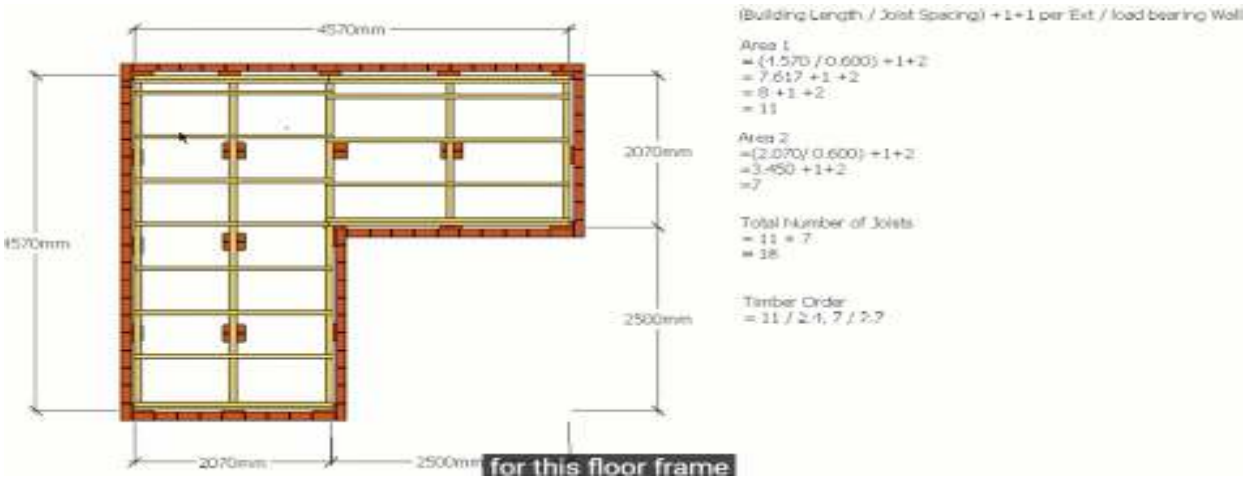
Suppose if the no. of tiles in a box is 11 nos. (no. of floor tile in a box varies as per the size, thickness, brand, etc)

Then, dividing the total no. of tiles by the no. of tiles in a box, we get

199 nos ÷ 11nos

= 18 boxes.

❖ **How to calculate floor joist quantity**



❖ **How to calculate floor joist span Floor joist**

A floor joist is a part of a floor system that acts as a beam, supporting the load acting upon the attached flooring material. In a floor system, we use several floor joists properly spaced from each other, so that subflooring materials like plywood or wooden planks are safe to walk on.

Spacing floor joists too far from each other means we would need lesser floor joists to cover our entire flooring. However, the floor might feel a little bouncy due to the lack of support underneath it. On the other hand, we can install the floor joists closer to each other so more of them can support the flooring material. But that could mean a more costly floor system.

We typically space floor joists 16 inches apart (measured from the centers of the joists). That way, we can lay an 8-foot (or 96 inches) long subfloor across 7 joists, as shown in the illustration below:

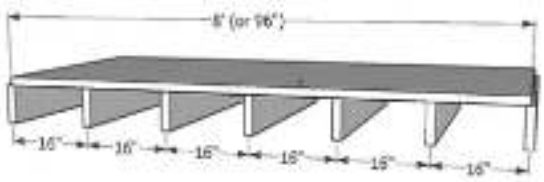


Figure1.20 Floor joist

We can space our joists closer or farther than 16 inches, but the other typical on-center spacing's are as follows.

But what if your subfloor material's length is not a multiple of 8 feet? In that case, you can use this formula to determine the joist spacing that will suit your preferred number of joists to support your subfloor material:

$$s = \frac{L_{\text{sub}}}{(n_{\text{sub}} \div 1)}$$

Where:

- S is the joist on-center spacing;
- L_\text{sub}L sub is the length of subfloor; and
- n_\text {sub} n subis the number of joists you want to support your subfloor material.

In this calculator, it is worth noting that we are only considering natural solid lumber joists. That means we've excluded the use of I-joists and open-web truss joists (these are engineered joists that span longer than solid lumber joists). Nevertheless, we still have a huge selection of wood species and lumber grades to choose from in this calculator. The data we've used for this calculator came from the.

- **Floor joist**

The first step in using this floor joist calculator is to choose whether you want to calculate floor joist count or floor joist span (the maximum length a particular floor joist size can span to support a specified load).

To use this tool as a floor joist cost calculator:

1.Enter the length and width of your floor.

2. Select the nominal joist size you wish to use. You can also enter the thickness and height of your floor joists using our calculator in advanced mode (which you can activate at the bottom).

3.Type in your preferred on-center joist spacing. It's advisable to choose a joist spacing among the typical values provided in the previous section of this text. Our floor joist calculator will then display the number and recommended length of floor joists and end joists you will need for your floor size. The end joists are the joists used to cover the ends of the floor joists. They run perpendicular to the floor joists and provide stability against the lateral movement of the floor joists.

4.Enter the price per floor joist and end joist and wastage percentage to determine the approximate cost of your floor joists.

On the other hand, here are the steps you can follow when using this tool as a floor joist span calculator:

1.Select the nominal joist size you want to analyze. Like when using this tool as a floor joist cost calculator, you can also see the actual thickness and height of your selected joist size in the advanced mode of our calculator. You can also change these values for custom-sized joists. We also use these measurements to calculate the area moment of inertia.

2.Enter the on-center joist spacing of the floor joists.

3.Choose the wood species and its lumber grade. In this step, our tool will instantly display the modulus of elasticity of your selected wood.

4.Then, pick the deflection limit you want to allow on this floor joist.

5.Finally, enter the total load per unit area your floor will have to support. After completing these steps, our tool will then provide you with the maximum allowable span of your specified floor joist.

❖ **To calculate many floor joists**

For us to estimate how much it costs to install floor joists, it is essential to learn how to determine how many floor joists we need for a project. Here is the formula we can use for that:

$$n = 1 + \frac{L - w}{s}$$

Where:

- n is the number of joists needed;

- L is the length of floor
- W is the actual thickness of floor joist
- S is the on-center spacing of the floor joists.

If we get a value for n with a decimal, we round up that value to the nearest whole number. That will be the number of floor joists we need. Take note that the length of floor is the measurement perpendicular to the floor joists. If we can get lumber with a length equal to or greater than our floor's length, we can get two pieces of that lumber for our end joists. Of course, you'll need to consider some budget for fasteners like nails and screws and other hardware like brackets and hangers. We did not cover these materials in our calculator, as their quantity and cost can vary greatly depending on the project and your preference.

❖ **Calculate floor joist span**

To find how far any particular size of floor joist can span, we need to combine two formulas for the vertical deflection, delta δ. The first deflection formula we need determines the allowable sag of a floor joist using a ratio. The sag or deflection of floor joist subjected to dead and live loads should not exceed a measurement equal to the span of the floor joist, L (in inches). In equation form, we express that as:

\small \delta = L / 240δ=L/240

We can also divide L by 360360, 480480, 600600, or 720720, depending on what loading combination you wish to consider in your calculation or how much deflection you want to allow. As a rule of thumb, we use 240240 for a combination of dead and live loads our floor will have to carry.

We then simultaneously use that equation with this maximum allowable deflection formula based on the floor joist material composition, its cross-section, and the load it supports:

$$\delta = \frac{5 \times u \times L^4}{384 \times E \times I}$$

Where:

- Delta δ is the maximum allowable deflection of floor joists;

- u is the uniformly distributed load a floor joist will carry;
- L is the span of the floor joist;
- E is the modulus of elasticity; and I is the area moment of inertia.

If you know the load that your floor will carry (say P in terms of force per unit area), you have to multiply it by the on-center spacing (s) that you plan for your joists to get its equivalent uniform distributed load along the joists:

❖ **Calculate the floor joist**

To calculate how many floor joists you will need, let's say on a floor that is 10 feet (or 120 inches) long and using 1.5-inch thick floor joists at 16 inches on-center spacing:

1. Subtract the width of your floor joist from your floor's length:
   120" − 1.5" = 118.5"
2. Divide that difference by the sum of the on-center spacing of the floor joists:
   118.5" / 16" = 7.40625
3. Add 1 to this value and round up the answer to the next whole number:
   7.40625 + 1 = 8.40625 ≈ 9 floor joists

1.5. Environmental Protection Requirements

❖ **Environment during Protect the Construction**

Environmental friendly business practices are a hot topic and the strong focus of businesses in nearly every industry, including construction. The great news is that often these solutions are not only better for the environment, but they're also better for your bottom line. Get started with the following guide:

❖ **Minimize Waste**

Construction produces a large amount of waste materials, period. There's no way around it, but you can and should look for ways to minimize the waste you're producing. Increasing the efficiency of your operations, optimizing the use of supplies and materials, and choosing products and methods that reduce waste are all great ways to reduce the production of waste materials for all your projects. Every little bit really does add up.

❖ **Industrial Recycling**

Explore recycling initiatives specifically aimed at the construction industry like the EPA's Industrial Recycling Program. This program focuses on recycling construction and demolition debris in other construction applications on site.

❖ **Efficient Energy Use**

Use tools, products, and materials that promote efficient energy use. Look for ways to improve the energy efficiency of your operations, materials used, and final products. Use the Energy Star Program as a guide.

❖ **Choose Green Solutions**

Look for products and materials specifically designed to be more environmentally friendly. Consider products that reduce the environmental impact of specific parts of your operations such as using an inflatable bladder dam for all your dewatering applications.

❖ **Protection of Ecological Resource**

It's important to protect the water, plant life, and animal species in the area of your project. Not only will the general public take note, but the government has regulations in place to protect the biodiversity of local ecologies. Your end goal is to complete your project with the highest quality, most efficient timeline, and the least environmental impact.

❖ **Certain terms used in this Law shall have the following meaning:**

1) **Environment** shall mean a set of natural and man-made values whose complex mutual relations make up the environment, i.e. space and conditions for life;

2) **Environmental quality** shall mean a state of environment expressed in physical, chemical, biological, aesthetic and other indicators;

3) **Natural values** shall mean natural wealth which comprises: air, water, soil, forests, geological resources, plants and animal life;

4) **Protected natural** good shall mean a preserved part of nature with special values and characteristics (geodiversity, biodiversity, landscape, scenery etc.), which has permanent ecological, scientific, cultural, educational, health recreational, tourist and other significance due to which it enjoys special protection as a good of general interest;

5) **Public natural** good shall mean a cultivated or uncultivated part of natural wealth, i.e. air, water goods, water-fronts, underground goods, forest goods, landscape or space equally accessible to all;

6) **Geodiversity** (geological diversity) shall mean presence or dispersion of various elements and forms of geological texture, geological structures and processes, geochronological units, rocks and minerals of different composition and genesis types and different pale ecosystems which have been changed in space under influence of internal or external geodynamic factors in the course of geological time;

7) **Biodiversity** (biological diversity) shall mean a diversity of organisms within a specie, among the species and eco-systems and it covers full genetic diversity, species and ecosystems diversity at local, national, regional and global level;

8) Register of environment pollution sources shall mean a set of systematized information and data on types, quantities, manner and place of introduction,

1.5.1. Environment Management Plan

The Environment Management Plan (EMP) would consist of all mitigation measures for each item wise activity to be undertaken during the construction, operation and the entire life cycle to minimize adverse environmental impacts resulting from the activities of the project.

- It would also delineate the environmental monitoring plan for compliance of various environmental regulations. It will state the steps to be taken in case of emergency such as accidents at the sites including fire.
- The Environment Management Plan (EMP) is aimed at mitigating the possible adverse impacts of a project and for ensuring to maintain the existing environmental quality.
- The Environment Management Plan (EMP) will be site specific plan developed to ensure that the project is implemented in an environmental sustainable manner where all contractors and sub-contractors, including consultants, understand the potential environmental risks arising from the proposed project and take appropriate actions to properly manage the risk.
- The main objective of the Environmental Management Plan (EMP) is to identify the project specific activities that would have to be considered for investigation of the significant adverse impacts and the mitigation measures required.

- EMP will also ensure that the project implementation is carried out in accordance with the design by taking appropriate mitigate actions to reduce adverse environmental impacts during its life cycle.

❖ **EMP will include four major elements:**

• **Commitment & Policy**: The management will strive to provide and implement the Environmental Management Plan that incorporates all issues related to air, water, land and noise.

• **Planning:** This includes identification of environmental impacts, legal requirements and setting environmental objectives.

• **Implementation**: This comprises of resources available to the developers, accountability of contractors, training of operational staff associated with environmental control facilities and documentation of measures to be taken.

Self-check -1	Question related to plan and prepare

Part I Multiple choice

Instruction: Select the best answer and encircle the letter: (each points 2 mark)

1._____Shall mean a state of environment expressed in physical, chemical, biological, aesthetic.

A. Environment B. Geodiversity C. Environmental quality D. Public natural

2. It use protect working in a very noisy environment harms the eardrums forever.

A. Ear protection B. Wearing clothes C. Safety goggles D. Helmet

3. Major element of Environmental management plan.

A. Commitment & Policy B. Planning C. Implementation D. All

4. It is used to control the horizontal and vertical alignment of wall surface and edges.

A, Plumb bob B. Hose level C. Angle / Try square D. Spirit level

5. One of the following is different from other.

A. Plumb bob B. Hose level C. Angle / Try square D. mitre cut saw

6. It is used to control the horizontal and vertical alignment of wall surface and edges.

A. Plan bob B. sprit level C. Hose level D. Tri square

7. ---------One of the following including in Work Health and Safety Regulation 2011.

A/Specific personal protective equipment (PPE) requirements;

B/Hazardous chemicals;

C/Fire protection equipment

D/ All of the above

8. Construction worker should aware one of the following safety rule

A/Specific Hazards

B/Probable consequence of involvement with the hazards

C/How hazards cab be avoided

D/ All of the above

9. What saw would be used to cut a 2x4?

A. Table saw

B. Circular saw

C. Saber saw

D. Band saw

Part II: Short Answer writing

Instruction: write short answer for the given question. You are provided 4 minute for each question and each point has carried 2 Points.

1. What are the main causes of injuries on the site for form workers?
2. Purpose Personal protective equipment (PPE)?
3. List down the personal safety materials used on during Floor farms activities?
4. Purpose Environment Management Plan?

Test III Say True or False

1. Objective safety Enhancing workability of employees by ensuring a safe and congenial work environment.
2. This floor joist calculator will help you when you buy floor joists for your next flooring or deck framing project.
3. Accidents are fallouts of carelessness and lack of responsibility.
4. Construction industry, often termed as ‘high-risk’, has a significant impact on the health and safety of the workers.
5. A floor joist is a part of a floor system that acts as a beam, supporting the load acting upon the attached flooring material.
6. Accidents generally occur while operating or working at unsafe speed one part of human cause.

Operation sheet-1	Plan and prepare

Purpose:- To apply quality work and health care

Instruction: - Using the right tools to perform your task within the given time. You have given 20Minut for the task.

Equipment and Tools

- Shovel
- Chisel
- Brooms
- Cleaning Materials

Precaution:-

- ✓ Safe working area environment
- ✓ Ensure the work area hazard free
- ✓ Avoid horse play
- ✓ Availability of proper tools and equipment

Procedure,

1.Wear your PPE properly.

2.Secure workshop manuals, Specifications, tools and equipment.

3.Sort different tools and materials based on their size and kind.

4.Select appropriate way of house cleaning.

5.Identify and prepare resources and technical requirements for floor farm and planks sheet

6.Observe the proper application of Occupational Health and Safety requirements.

7.Quality Criteria: Assured to follow the kaizen principle

LAP Test 1	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instruction I: Given necessary templates, tools and materials you are required to perform the following tasks within 20 min.

Task 1: Prepare Work Area

Unit Two: Set out sub-floor frame

This unit to provide you the necessary information regarding the following content coverage and topics:

- Installing Structure/ posts/ stumps/ piers
- Support structure/ piers/ posts

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Apply Install Structure/ posts/ stumps/ piers
- Check support structure/ piers/ posts

2.1. Install Structure/ posts/ stumps/ piers

Floors are provided to divide a building into different levels for creating more accommodation one above the other within certain limited space. One of the major purposes of floor is to provide a level surface capable of supporting the inmate/occupants of a building together with their belongings, furniture, equipment, stored materials. In the traditional floor constructions, the floor is needed to have a clean, smooth, impervious level and durable surface. They are designed to be dust free and easy to clean so that they will have good aesthetic appealing. Exclusion of dampness, sound and thermal insulation, fire resistance and adequate strength and stability are among the purposes of the floor. The bottom floor near the ground level is known as ground floor and other floors above it are termed as upper floors or 1st floor, 2nd floor, etc. If there is any accommodation constructed below the natural ground level, it is known as basement and the floor provided in it is known as basement floor. A floor may consist of two main components:

(I) a sub-floor, which provides proper support to floor covering and the superimposed loads are carried by it.

(ii) Floor covering, which provides a smooth, clean, impervious and durable surface.

❖ **Sub floor**

Wood flooring by design is not to be used to strengthen/stiffen a subfloor and will not do so. The subfloor is the foundation for the wood floor. The final wood floor installation is only as good as the subfloor it is installed over. With new construction, it is the responsibility of the builder to ensure the facility is designed and capable of sustaining an environment conducive to the building materials being used in it.

The wood flooring contractor shall not be responsible for the design or installation of the subfloor system, inadequate deflection limits, improper joist/floor truss spans, and spacing/panel thickness combinations, or any subsequent flooring problems resulting from prior jobsite damage, unless otherwise contracted to do so. If it is the opinion of the wood flooring contractor that the subfloor is not in suitable condition for hardwood flooring, it is the responsibility of the wood flooring contractor to either remedy the subfloor and/or to notify the builder/owner prior to installation to allow them to make it suitable for the flooring being installed.

❖ **The two most common types of subfloors are:**

Concrete slab subfloors- which may be on-ground or suspended above the ground Concrete slabs are very popular in project homes and commercial buildings, especially in ground floor construction. This drawing shows a cross section of a typical on-ground slab for a brick veneer building. You can see that there's an external skin of brickwork and an internal wall frame in timber or steel. Because brickwork is porous and absorbs moisture, there is a cavity between the external and internal skins to stop moisture from seeping through and reaching the inside wall.

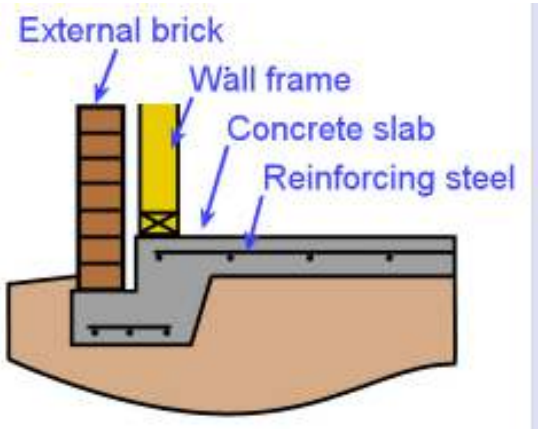


Figure 2.1 Concrete slab subfloors

Timber or steel framed - which use floor joists to support structural sheet flooring, such as particleboard or plywood.

Most raised floors in domestic buildings use plywood or particleboard sheets as structural flooring, supported by a frame of timber joists. In ground floor construction the joists rest on **bearers**, which in turn are supported by brick piers, timber stumps or some other column or wall. Occasionally steel framing is used for the bearers and joists, but the same structural principles apply.

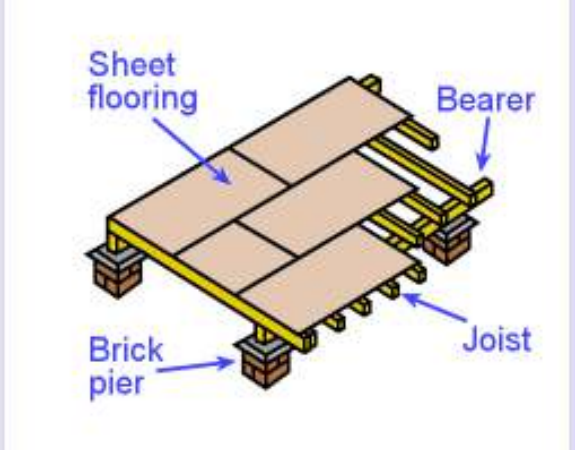


Figure2.2 Timber or steel framed

❖ **Underlayment**

You may not always find an underlayment because it's not required. Underlayment is always a floating type of flooring, and it should never be glued down to the subfloor with adhesive in case you need to repair either layer. Here are types of underlayment for different finish floors:

Wood: If you are installing solid hardwood or engineered wood flooring, you may be putting down a type of even, blemish-free plywood that is specifically engineered for underlayment.

Tile: For wet, mortared applications, such as tile and stone flooring, the underlayment may be a cement backer board.

Laminate: The underlayment for laminate flooring is a thin foam that comes in rolls and is then taped together.

❖ **Purposes Sub floors**

The laying of subfloor is the final stage in completing the floor frame. Ether plywood or common boards can be used.

- The sub floor serves for three purposes:
  - ✓ It adds rigidity to the structures.
  - ✓ It provides a base for finish flooring material.
  - ✓ It provides a surface up on which the carpenter can layout and construct additional framing

https://youtu.be/d5m7rYG2Lzg?t=347

Sub flooring of the board or shiplap type is nailed at each joist with 8d nails. Use nails to at the distance of 10 inch along the joists and 6 inch along the length of headers and stringer/end joists. See on the fig below.

Figure 2.3 Subfloor

If subfloor is tongued and grooved on ends and edges, end joints need not be made over joists. Subfloor is preferably laid without cracks between boards. If accumulation of water on subfloor during construction is likely, it may be desirable to leave cracks to permit drainage.

- **Ply wood**

In most modern construction, ply wood is used for subflooring. It provides a smooth, even base and acts as a horizontal diaphragm that adds strength to the building. Plywood can be installed rapidly and usually insure a squeak-free floor.

- **Glued floor system**

In a glued floor system the subfloor panels are glued and nailed to the joists. It increases the stiffness. In addition, the system insures squeak-free construction, eliminates nail-popping and reduces labor costs.

Figure 2.4 Floor Framing

❖ **The following are key points in the floor framing plan:**

1. All sill plates are comprised of treated 2x6” lumber and sit over foam sill plate sealer.
2. The sill plates are anchored to the block wall.
3. The squares of the sill plates is determined and set before laying of the beams.
4. All joists are comprised of 2x10” lumber and are installed 16” on center.
5. Center girder beams are doubled up but are installed in a phased approach. The first row of beams is installed to allow nailing into the joists from the beam, then the second beam is installed and is doubled up with the first beam. Beams are comprised of 2x12” and they sit on interior support masonry piers. Beam seams are always on the support piers and these seams are staggered.
6. Band joists sits on the sill plate and are comprised of 2x10” lumber.
7. Joists run between the band joists and the girder beam.
8. They are always set up flush with the top of the band joist and beam. Joists are nailed from the band joists flush with the top of the band joists that cover the end walls; the other end of the joists are nailed into or from the beams that sit on interior support piers.
9. A ledger board runs parallel to the beam and is nailed into both sides of the beam under the attached joists.
10. When indicated on the plan, additional joists or joist blocking is required to support walls that will sit parallel to the joists.
11. Blocking will be required for support of plumbing fixtures such as toilets, tubs/shower stalls.

❖ **Sub floors**

Sub-floors provide a level surface to support the flooring and the rest of the house structure above it. Everything that lies underneath the top of the floor, is regarded as sub-floor. While in upper stories it means everything between the joists and the finished flooring. The sub-floor is part of a building's substructure, so it is very important to use the correct materials for the sub-floor installation and do the work carefully and accurately. The kind of sub-floor and sub-floor material used in construction depends on the geographic area the building is in, and the kind of floor (fitted or platform) you intend to install.

Subflooring provides a base for finish flooring and also serves as a platform during construction. It may be made of boards laid either at right angles or diagonally across joists. Or the subfloor may be made of plywood or other panel products that are laid perpendicular to the joists.

A plywood subfloor has panels that are laid in a staggered fashion, with the ends and edges butted together; the panels are nailed (and sometimes also glued with construction adhesive) to the floor joists.

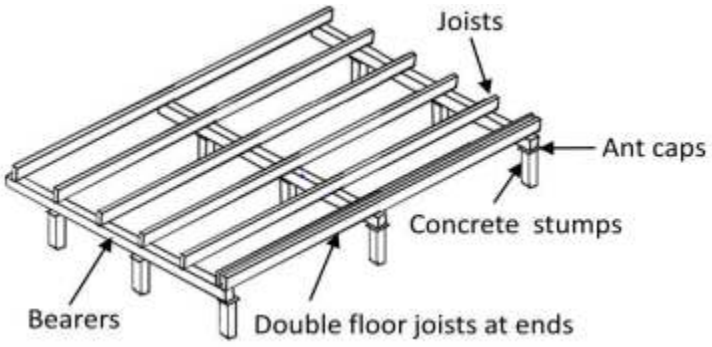


Figure 2.5 Sub-floor component

❖ Sub-floor components the components of a sub-floor are:

➢ **Stumps**

If your floor is supported by many columns or stumps, then you have a stump subfloor. According to the lie of the land, these will be of varying heights to keep the floor perfectly level. It is very important that there are enough stumps to support the weight of your house, and that they are spaced in such a way as to provide maximum strength. Stumps are used to hold up the floor frame, which in turn supports your chosen flooring surface.

Figure 2.6 Stumps

➢ **Bearers**

Bearers carry the loads from the floor joists across large spans. In upper stores, if the rooms underneath are large, the joists may not be able to economically span the full width of the room and a bearer will offer an intermediate support. On lower stores, the bearer may span between the stumps. The bearers rest on top on the piers and usually run the direction of the longest wall. Joists are then laid in the opposite direction.

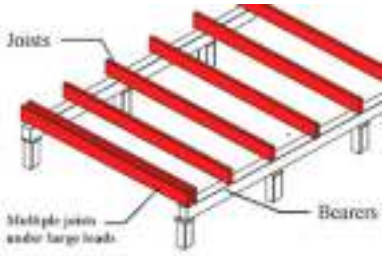
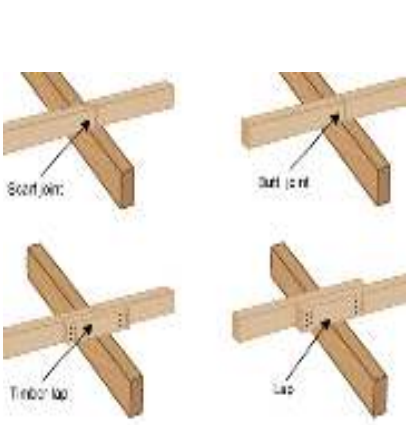


Figure 2.7 Bearers

❖ **Joists**

Floor joists are firmly connected to the bearers. Where joins are required these must be over a bearer



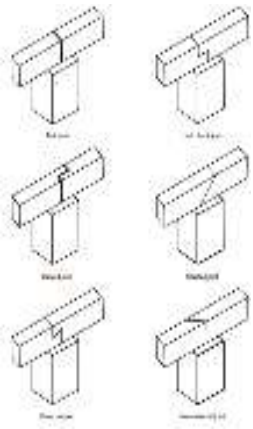


Figure 2.8 Joists

The thickness and stiffness of the subfloor determine the types of finish materials that can be laid on top of it. If your house is built on a concrete slab, the slab can serve as a base for almost any type of flooring. But, if your home has a plywood or board subfloor, it's important to check out the type and thickness of the material you intend to use to determine what your limitations are. For instance, a floor that is slightly flexible or springy is not suitable for rigid materials such as ceramic tile and stone because the grout or materials will crack with movement.

A. Traditional lumber joists are usually 2"x or 3"x dimensional material and are sized according to these factors:

1. Species and grade of the wood.

2. Spacing and span of the joists. 3. The design load requirements

B. I-joists have a higher strength-to-weight ratio than lumber joists and often are used for longer spans. They use top and bottom flanges that typically are solid lumber, structural composite lumber, or laminated veneer lumber (also called LVL). They also use web material that typically is made of oriented strand board (OSB).

C. Floor trusses usually are made up of 2"x4" or 2"x3" lumber on top and bottom chords with an open-web configuration with metal plates. The lumber in the floor truss flanges usually is oriented flat-wise providing for up to 3½" wide bearing surfaces. These trusses are often used for longer spans than lumber joists.

Maximum subfloor deflection limits are set by building codes. They are expressed as a fraction: clear span in inches (L) over a given number. Building code allows for the maximum allowable floor member live load and concentrated load deflection for wood framed floor systems to not exceed L/360, where "L" is the clear span length of the supporting members.

1. A subfloor system built to this minimum specification is sufficient for most wood floor installations.

2. Some thinner-profile (solid and engineered) wood flooring products may benefit from a stiffer subfloor system.

3. Subflooring systems that lack adequate stiffness can contribute to performance problems in wood floors such as fasteners pulling out of the subfloor, excessive noise, and potential damage to the surface finish. Where subfloor deflection is a concern, a qualified professional can help the

end-user determine the best method to stiffen the subfloor system. Some common options for stiffening a subfloor system include:

a. Increasing the subfloor panel thickness.

b. Adding a second layer of wood panel subflooring to the existing subfloor.

c. Selecting a high-performance subfloor product that has a higher design stiffness than commodity panel options.

d. Increasing the depth of the floor joists/ trusses.

e. Selecting a wood grade for the floor joists/trusses with a higher modulus of elasticity.

f. Reducing the floor joist/truss spacing.

g. Reducing the span of the floor joists/ truss

Nail each piece of OSB with ring shanked nails, 5 nails along middle joists and 7 nails on each end. Galvanized nails must be used where sheathing is nailed into treated band joists. You may find it helpful to chalk lines (use blue chalk) before nailing.

When beginning the second course of subfloor, keep these guidelines in mind. The tongue side should fit inside the groove, but should not be perfectly tight. Use a sledge hammer and a buffer board (scrap 2x4) to encourage the OSB.

Stagger your seams by 4' (three joists apart). The subfloor should come to the edge of the outside of the band joist, so when you get to the end, it most likely will be necessary to use small strips .

2.2. Support structure/ piers/ posts

Post and pier construction uses a series of posts installed under the home which are mounted to concrete piers. Sometimes cladding or facing is added to cover the space below the elevated house. This type of foundation is common in coastal pre-FIRM structures.

Piles foundations are typically found in coastal areas and are used when there is a layer of weak soil at the surface. Supports are driven into the ground and embedded several feet below grade.

Post and pier construction uses a series of posts installed under the home which are mounted to concrete piers. Sometimes cladding or facing is added to cover the space below the elevated house. This type of foundation is common in coastal pre-FIRM structures. Post-FIRM, or structures built after the effective FIRM was adopted by the community, must be built with more resilient, NFIP-compliant foundations.

❖ **Interior Wood Post on Spot Footing**

Another option for piers on either continuous or spot footings is the specification of wood posts. Pressure-treated wood posts, including solid lumber such as 6x6s, or multiple plies of dimension lumber, may be installed on appropriate post anchor bases and attached to the top of the footing or wet-set into the footing. At the connection to the footing, the post anchor base must resist lateral, shear and uplift loads, as required. At interior wood post piers, connections at the top of the footing may also be required to resist lateral, shear and uplift loads from the structure above. For piers along the perimeter, bracing of the posts to resist such loads will be required. Where wood post piers are not required to resist lateral or shear loads from the supported structure above – as may be the case with interior piers of the structure additional bracing of posts should not be required.

Some builders prefer to wet-set pressure-treated wood posts into appropriately sized concrete spot footings. Uplift resistance can be provided through insertion of reinforcement bars or bolts into the post prior to pouring concrete. In such cases, the recommendation is made to take appropriate steps to prevent surface water penetration into any cavity between the concrete spot footing and the wood post that may be created by shrinkage of the post over time.

❖ **Sub floor frame Installation Considerations**

The condition of the floor structure, ensuring it is free from rot (dry rot and wet rot), especially at the abutment to any external walls, tassel or dwarf walls;

- Ensuring there is no existing evidence of dampness, staining or condensation on the faces of the floor;
- Ensuring there is no evidence of infestation (bore holes or active infestation);
- The type, suitability and condition of floor timbers, substrates and any openings;
- The type and condition of floorboards or breather membrane present;
- Room space ventilation requirements

2.2.1. Make sure your building project uses adequate construction materials.

❖ **Wood Plank**

Wood planks are a traditional subflooring material, but they have been mostly replaced by plywood. Planks measure 1x6, they are made from softwoods such as pine, and they are nailed into wood joists with standard box nails. However, they tend to loosen over time, causing squeaky floors. Ring-shanks and fluted subflooring nails are a better option, since they resist

pulling out. Homes that were built with wood plank subfloors are usually remodeled with particle board or hardboard underlayment's, to smooth the surface for finishing layers.

❖ **Plywood**

Plywood is considered the most popular material used for subflooring, it has been used since the 1950s and remains one of the top choices for contractors. Standard plywood works perfectly fine as a subflooring material, but the best option is ¾" tongue-and-groove plywood subflooring. This system has interlocking tongue-and-groove edges, which help prevent movement along the panel edges, resulting in a stiffer floor.

Plywood panels are typically glued to the floor joist with construction adhesive, and then fixed with ring-shanks or fluted subflooring nails. Thinner subflooring (½" or 5⁄8" plywood) may be suitable for low traffic floors with carpeting or resilient flooring finishes. Thicker subflooring is recommended for hardwood, and necessary for floor tiles.

❖ **Oriented strand-board**

Also known as OSB, oriented strand-board is a popular subflooring material. OSB is similar to plywood subflooring, it has the same installation process, and it offers similar performance. However, OSB can often achieve lower costs than plywood.

❖ **Concrete**

Concrete subflooring uses slabs, which provide a hard, durable, steady and often smooth subfloor. Finishing floorings such as tiles and stones can be directly installed over concrete, but in most cases an underlayment is necessary.

Concrete is not impervious to water or vapor. Therefore, when installed in moisture-prone areas such as basements, concrete requires a moisture barrier. Solid hardwood floorings are not recommended over concrete in basements or anywhere below grade, even with moisture barriers. Concrete presents some challenges when it comes to temperature and hardness, since it conducts building heat into the ground and is almost impossible to nail into.

❖ **Mixed Subflooring's**

Here are cases in which a concrete slab is paired with plywood or OSB elements to create a composite subflooring. One method includes fastening 2"sleepers over the concrete and covering them with plywood subflooring. Another method consists of laying down a floating subfloor made with tongue-and-groove OSB panels, adhered to a base layer of plastic or rigid foam

insulation. This base serves as a moisture barrier from concrete dampness, and OSB works as a flat subfloor ready for finishing layers.

❖ **Best Subflooring Material for Finished Floors**

FINISHED FLOOR	SUBFLOOR	REASON
Tile	Concrete Plywood with cement board underlayment	Requires a hard surface to avoid flexing which can lead to cracks
Hardwood	Plywood	Easier installation and compatibility
Laminate	Plywood with a thin plywood underlayment	Similar to hardwood but thinner, the underlayment will protect laminate from dents and ridges

❖ **Frame Installation Methods**

1. To insulate a floor correctly, it is important that the whole floor area is improved to the same level, and floors are not insulated in isolation of other floor areas, this helps to alleviate issues of cold bridging and unwanted moisture movement in voids.
2. In some instances, it may be preferable to insulate the floor from above, by removing the floorboards. This may be appropriate when:
    - ➢ The room is going to be refurbished anyway; and,
    - ➢ The existing floorboards can easily be removed without being damaged excessively; or,
    - ➢ The existing floorboards are in poor condition and they are going to be replaced anyway.

3. Alternatively, it may be possible to insulate from under the floor, which may be appropriate when:

- ➢ There is an unheated basement or cellar which allows easy access to the underfloor area;
- ➢ There is a sufficient gap under the joists to use the crawl space to work. In practice that means there are about 5 or 6 bricks below the bottom of the joists (38-45 cm or 15 "-18 of space). It is, however the responsibility of the installer to undertake a comprehensive risk assessment before any works are undertaken in line with the regulatory requirements;
- ➢ An access hole is already in existence or can easily be created; or

- When the crawl space allows access to most of the house.

4. It is not recommended to fully fill the void with blown insulation material (such as EPS beads) under any circumstances as Building Regulations require a minimum of a 150mm clear ventilated gap between the floor and ground below.

5. In all cases, compliance with health and safety requirements and access to confined spaces should take priority over any proposed installation approach and an appropriate risk assessment and method statement produced and followed.

Methods of applying roll or batter insulation:

i. The first main method of applying roll or batter insulation is to insulate from above. In these instances, existing floorboards and/or decking should be removed, and the insulation should be applied using a method stipulated and approved by the manufacturer, in terms of using materials not capable of supporting themselves (mineral wool, glass wool, sheep's wool, wood fiber etc.). This would normally involve some form of substantial scaffolding mesh or a 30 netting designed for the specific use of supporting insulation. Garden netting or other nonspecific netting must not be used. The floorboards may then be re-laid.

ii. The second main method of applying roll or batter insulation is to insulate from under the floor. In these instances, a sufficient and safe working space must be available, either by using the crawl space underneath the insulation, or where access can be gained to fit the insulation into place and then secured using battens, netting, membranes, or mesh. The health and safety of the installers should be carefully considered to ensure a safe working space, given that they may be working in enclosed spaces, with potential exposure to toxic materials or substances in the ground. The suitability of PPE should also be considered.

iii. Removing existing floorboards can be difficult, disruptive and increases the risk of damaging the boards. If the floorboards are tongue and groove, then they will need to be removed in order (and numbered). This may require specialist intervention where boards are more firmly nailed down. 78.Alternatively, an installer may wish to saw between each floorboard to cut through the tongue and groove before levering them up (please note that unless new tongue and groove boards or additional airtightness is

required, then a breathable membrane should be used or this may lead to detrimental effects on airtightness even with additional insulation).

iv. The floor should be scanned using appropriate equipment to identify the location of electric cables and pipework. Where the boards run the width of the room, it may be necessary to either cut the boards in half, or remove the skirting to allow the boards to be lifted. This level of disruption must be communicated to the resident and customer beforehand.

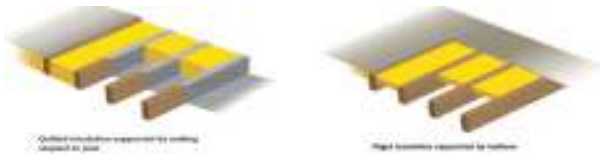


Figure 2.9 Frame Installation

❖ **Insulating using spray foam**

i. An insulating spray foam product should be applied between timber joists of a suspended ground floor construction. This can be done from a crawl space between the underside of a floor and the ground surface below.

ii. The product should be sprayed to the underside of an existing floor with any excess material cut to suit the specification.

iii. Alternatively, the product can be installed from above a floor where a floor covering has been removed. It is critical that a breathable membrane or lnsupanel (Expanded Polystyrene Panel) rafter system is installed between floor joists to receive the product and ensure that the product does not contact the ground surface below with any excess material cut flush with joist tops. In both applications, the ventilation of a void between the timber joists structure and the ground surface below must be maintained in accordance with the guidance set out in.

iv. The product should not be applied over electrical cables, recessed lighting, existing vents or ventilation gaps. Instead, installers should consider re-routing, re-laying in conduit/trucking or de-rating electrical cables. Existing recessed lighting (if applicable) should be replaced with ventilated fittings which incorporate a protective fire hood. Care is needed for design detailing of joints at service/flue pipe openings and should be in accordance with BS6093.

v. For suspended upper floors, adequate fire resistance and fire stopping should be provided by floors between homes and at penetrations. Upper floors should be constructed to ensure structural timber is located away from heat sources.
vi. The product should not be applied over junctions with external walls required to provide a minimum period of fire resistance. Care should be taken to ensure continuity of fire resistance at junctions with fire-resisting elements, in accordance with the national Building Regulations.
vii. The installed product should be separated or shielded from any heat-emitting appliance, fire place, chimney or flue pipes passing through a suspended floor and any potential source of ignition where the temperature is in excess of 70 °C, by non-combustible insulation in accordance with the provisions of the national Building Regulations. The product should also be 8 cm from any heat emitting devices and potential source of ignition, where the temperature is > 82° C.
viii. When installing with joists that run parallel to the external wall, the spray insulation should be tapered away from the wall in line with the manufacturer's specification.

❖ **Sub-floor ventilation**

The durability of suspended timber floors is in most circumstances totally dependent on there being adequate and suitable cross-flow ventilation to the void below. It is essential that the ventilation is effective and unobstructed by any new materials, debris, or other detritus material. When assessing the effectiveness of any sub-floor ventilation it is paramount that an inspection takes place of the floor levels externally in relation to the internal finished floor level. External works may have been undertaken since the property was originally constructed, such as new pavements, decking, soft landscaping or disabled access ramps. These may result in the air bricks and other vents becoming obstructed. Raised external ground levels if caused by soil or soft landscaping should be carefully reduced to restore full cross-flow. Where this is not possible, the use of telescope vents may provide a technical solution to maintaining the required ventilation.

It should be noted that suspended ground floors were occasionally constructed without ventilation paths below, although not common practice. If it is noted during any inspection that the timbers and support walls are relatively dry, this may indicate that conditions are stable and therefore careful thought must be given to the effectiveness of adding insulation in these circumstances. It is not unreasonable to assume that these stable conditions may have been

helped by ventilation through board gaps to the room above. Under these circumstances, the addition of insulation may significantly obstruct this ventilation, and the addition of new ventilation paths below the floor may therefore be necessary, including through tassel walls (where present).

❖ **What Determines Subfloor Thickness**

The minimum thickness of plywood for subflooring is about 5/8 inch. Since it does not hold fasteners as well as plywood, OSB must be a little thicker, or at least 23/32 inch. There are several factors that determine what subfloor thickness is optimal for added benefits like insulation. Note that all these variables should be taken into account collectively since each one can be limiting factor in subfloor thickness.

The spacing of the joists that the subfloor sits on is a huge factor in determining thickness. For structural purposes, the farther apart the joists are, the greater thickness of subflooring required. For instance, if the joists are 16 inches or less apart, a 1/2 inch of subflooring may be enough. In older homes, where the joists may be farther apart, you will need thicker subflooring for stability. This will require at least 7/8 inch plywood and 1 inch thick of OSB.

The stiffness of subflooring has a lot to do with how your floor feels underfoot. It also plays a major role in ensuring that your flooring stays flat and even. So, it is imperative to select the appropriate thickness of subflooring relevant to your home's structure.

The reason this is relevant is that, while thicker subflooring may be better for insulation, it could limit the vertical space remaining for underlayment options.

❖ **Vertical spacing**

Flooring material thickness also should take into account a product's insulating capacity or "R-value." Building materials with a higher R-value have the ability to keep heat from escaping the flooring during the winter and keep it out during the summer. For a basic example, wool carpeting will have one of the highest R-values, while thin, engineered wood will have one of the lowest.

The same goes for subflooring. Plywood has a lower R-value (1.1 per inch) than OSB (1.4 per inch). So, while structurally you may be able to get away with thinner plywood, it will have a lower insulating quality than OSB of the same thickness.

This is important to consider, especially if the space between your flooring and the crawlspace or slab is limited. In short, for tighter vertical spaces, you would want to go with a higher R-value

product to ensure you are getting the desired amount of insulation.

Self-check -2	Question related to Conduct Structure/ posts/ stumps/ piers

Part I: Short Answer writing

Instruction: Select the best answer and encircle the letter: (each points 2 mark)

1. What's a slab-on-grade floor?
2. Why is pressure-treated lumber used for sill plates?
3. Why are joists sometimes used that are structurally stronger than required to carry expected floor loads?
4. What are the main advantages of advanced framing techniques?
5. Why should joist's crowns be placed up?
6. Why do sill plates need to be set level?
7. What are three common subfloor materials?
8. What is the standard subfloor thickness?

Part II Multiple choice

Instruction: Answer all the questions listed below. Use the Answer sheet provided in the next page: (2points each)

1. Provide a level surface to support the flooring and the rest of the house structure above it.

   A. Sub-floors
   B. Planks
   C. Tile
   D. Wood Plank
   E. All

2. Which use floor joists to support structural sheet flooring, such as particleboard or plywood.

   A. Timber firm B. Concrete slab C. Underlayment D. Underlay

3. Which type of floor is used for residential buildings?

A. Ground timber floor
B. Single joist timber floor
C. Double joist timber floor
D. Framed timber floor

4. Floor under the flooring is called:

A. Plinth
B. Sunken floor

C. Sub floor

D. Hind floor

5._____floor is used for spans of more than 7.5m.

A. Framed timber

B. Stone

C. Glass

D. Double joist timber

6.Name the short pieces installed parallel to the common joists when framing floor openings.

A. Tail joists

B. Mini joist

C. Purlin

D. Header

Part -I Matching

Instruction: select the correct answer for the give choice. You have given 1 Minute for each question. Each question carries 2 Point.

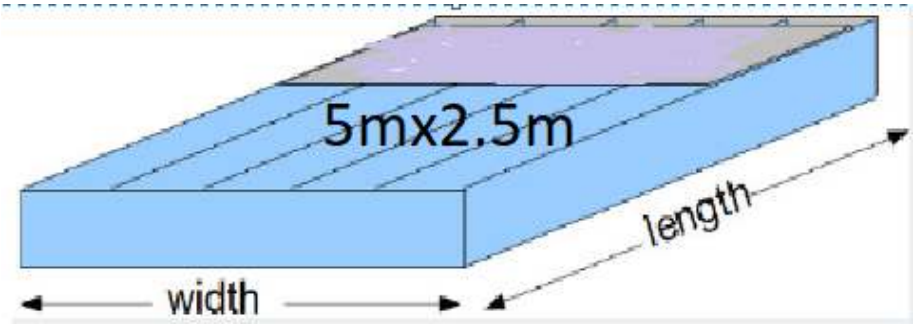
A	B
---------1. Mixed Subflooring's	A. Modern construction, used for subflooring
---------2. Post and pier	B. Installed under the home
---------3. Joists	C. Room space ventilation
---------4. Laminate	D. firmly connected to the bearers
---------4. Ply wood	E. Rolls and is then taped together.
---------5. Stumps	F. Concrete slab is paired with plywood
	G. floor is supported

Operation sheet-1	Set out sub-flooring frame

Purpose: - To know set out sub-floor frame

Instruction: -Properly set out sub floor frame. Using the right tools to perform your task within the given time. You have given **2hr** for the task.

a) The calculator computes the area of the floor
b) Computes the number of floor joists needed for a deck. It returns the number of joists and plate boards
c) Number and Length of Floor Joists
d) Number of Joist Hangers
e) Compute the Cost of Floor Joists



Figure

❖ **Tools and equipment**

- Level
- Chalk Line
- Tape Measure
- Speed Square
- Circular Saw
- Nail Gun
- Palm Nailer

❖ **Materials**

- 2 x 6 pressure treated lumber
- ¾ inch pressure treated plywood
- Joist hangers
- Fasteners – 3” framing nails 16d and 3” exterior grade Simpson screws
- 2” wood screws (for plywood)

❖ **Precaution:-**

- Eye Protection. Typical Forms: Safety glasses, welding helmets, face shields. ...
- Hearing Protection. Typical Forms: Earmuffs, earplugs. ...
- Head Protection. Typical Forms: Hard hats, bump caps, and headwear. ...
- Respiratory Protection. ...
- Foot and Leg Protection. ...
- Body Protection.
- Manage waste disposal
- Clean site is a safe site

❖ **Procedures**

Step1: Draw up a basic floor framing plan. Before you begin cutting or measuring, grab a pencil and paper and sketch an outline of your floor.

Step2: Label the dimensions of your floor framing plan. Fill in your outline with specific measurements for each area where you'll be installing a separate piece of lumber

Step3: Add up each part of the framing plan to calculate your materials. Once you've drafted your framing plan, review it carefully to determine exactly how much lumber you'll need.

Step 4: Lay out Deck Blocks and Level the Area

I've found that most sheds can easily sit on deck blocks instead of pouring a concrete slab foundation. They are much cheaper and more user-friendly, especially if you are new to shed building.

Step 5: Build the Outer Frame

Some people will say that you can build the frame with 2 x 4 lumber, but I prefer to use 2 x 6 pressure treated lumber instead. The added stability from a 2 x 6 over a 2 x 4 will be noticeable, especially if you are looking to store heavier items.

Step 6: Check if Your Floor Frame is Square

This is an often overlooked step, especially by beginners. You need to make sure that the frame you built is square.

Step 7: Add the Joists

I like to put the first joist right in the middle of the frame. If your frame is square (from the step above), then you should be able to cut each joist the same length.

Step 8: Attach the joist

Hangers to the frame using the Simpson screws. I like to use a cut-off block from a joist to align each so it is centered on my mark and flush with the top.

Step 9: Drop the joists

Into the hangers, you may need to tap them with a hammer. Use the 3” nails to attach the hangers to the joists. Angle the nails so the go through the joist and into the frame.

Step 10: Lay the Plywood

It’s a good idea to offset the seams on the plywood to add to the stability of the shed floor. I like to make my cuts and lay out all the plywood to get it even on the frame before I start screwing it down. The plywood is milled square, so it will also help ensure your frame is square too.

Lap Test-2	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within **2hr**. The project is expected in group to do it.

Task 1: **Set out sub-floor frame**

Unit Three: Install timber bearers

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Bearer material
- Damp proof course and termite
- Locate and fixe bearers

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Apply Mark and cut bearer material
- Perform damp proof course and termite
- Perform Locate and fixe bearers

3.1. Mark and cut bearer material

❖ **Standard Mark**

The use of the Standard Mark is governed by the provisions of the Ethiopian building code **Standards Act, 1986** and the Rules and Regulations made there under. The Standard Mark on Products covered by an Ethiopian Standard conveys the assurance that they have been produced To comply with the requirements of that standard under a well-defined system of inspection, Testing and quality control which is devised and supervised by BIS and operated by the Producer. Standard marked products are also continuously checked by BIS for conformity To that standard as a further safeguard. Details of conditions under which a license for the use of the Standard Mark may be granted

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❖ **Floor lengths**

Flooring is generally supplied in random length packs up to 4.8 m in length. The average length is often between 1.8 m and 2.1 m. Packs of shorter overall length are also available from some suppliers to facilitate floors in high-rise buildings that require product to be taken to the appropriate floor by lift.

The minimum length for timber being fixed to joists is 900 mm, based on a 450 mm joist spacing. In some instances, if it is known that the floor will be laid over a structural sub-floor, then lengths shorter that 900 mm may be provided. Ordering flooring

When ordering timber flooring, the following details should be provided to the timber supplier:

- species (or species mix)
- grade
- profile and end-joint type
- Cover width
- thickness
- quantity (in linear meters)

Flooring is generally supplied within the moisture content range from 9% to 14%. For larger jobs in specific environments a different range may be specified.

To calculate the linear meters of flooring required, the following method is recommended:

Total length of flooring required = Area of floor (m2) x 1000 + Wastage
Cover width (mm)

Allowance for waste should be approximately 5% for end-matched flooring and 10% for plain end butt joined flooring. Depending on the T&G sub-floor supporting system (e.g. joists, plywood on slab etc.), timber floors will both feel and sound differently when walked on. Generally T&G timber floors laid over joists or battens will have more spring under foot and there is likely to be some vertical movement at board edges and end-matched joints when walked on. Some squeaks can therefore be expected from most timber floors of this type. Squeaks can occur from movement of one board edge against another or from boards moving on nails. Squeaks are often more prevalent during drier weather due to loosening at the joints. Floors that are laid over plywood on a slab will have a firmer feel underfoot and some areas may sound dummy.

Similarly, when floors are glued directly to concrete the feel is firmer, and again some boards may sound 'dummy' when walked on.

In cooler climates, slab heating may be present. Due to the direct heating effect on the timber and intermittent use throughout the year, substantial seasonal movement can be expected. Although strip flooring can be used, if care is taken with appropriate product selection and installation practices it may be preferable to use engineered timber flooring products

Where less dimensional changes would be expected. Even with these products care is still necessary.

- **Timber floors**

- The purpose of a floor is to provide a level surface capable of supporting:
  - ✓ The occupants of a building,
  - ✓ Furniture,
  - ✓ Equipment, and
  - ✓ Sometimes the internal partition.
- Primary functions of a floor:
  - ✓ Provide a level surface with sufficient strength to support the imposed loads of people and furniture.
  - ✓ Exclude the passage of water and water vapor to the interior of the building.
  - ✓ Provide resistance to unacceptable heat loss through the floor.

- ✓ Provide the correct type of surface to receive the chosen finish.

➢ To perform its function a floor must satisfy the following requirements:

- ✓ Adequate strength and stability,
- ✓ Adequate fire resistance,
- ✓ Sound insulation,
- ✓ Damp resistance, and
- ✓ Thermal insulation.

➢ **Components of a floor**

A floor is composed of two essential components:

- ✓ Sub-floor, base course or floor base
- ✓ Floor covering or simply, flooring

❖ **Install Bearers**

1. Mark and cut the stumps

First, we need to mark the stumps at the bottom of the bearer and cut them off. To work out where to cut, you have to subtract the height of the joists, bearers and decking from the overall height of your deck. Use a combination square to mark the stump. (Using this tool ensures your line and stump will be straight when you start cutting.)

Figure3.1 Mark and cut the stumps

2. Measure bearer

Use your tape measure to work out the distance from your house to your string line. This will determine the length of the bearer.

Figure 3.2 Mark and cut the stumps

3. **Cut bearer**

Once you know the length of your bearer, cut it.

Figure 3.3 Cut bearer

4. Join bearers

If your deck is quite long and wide, it's a good idea to fix two pieces of timber together to provide sufficient strength. You can do this with a nail gun.

Figure 3.4 Join bearers

❖ **Install Bearers**

Bearers are easily installed using framing nails and should always be tied down with hoop iron. Most importantly, remember to always nail on both sides of the bearer. Figure Install bearers

- ✓ The fact that wood can be glued, laminated or bonded to metal or plates make it versatile construction material.
- ✓ Timber floors essentially consist of boarding supported on timber joists called floor joists.
- ✓ The structural element of timber floors is the joist.
- ✓ The joists are designed to carry the necessary load across the span, and the floor planking adds to the rigidity of the floor.
- ✓ Timber floors though quite light in weight, have poor fire resistance and sound insulation properties.
- ✓ The resistance of wood to fire and insects can be improved by coating.
- ✓ Care also should be taken in moisture flow.

3.2. Damp proof Course and Termite

Introduction to damp proofing:

Damp proofing is a type of moisture control applied to walls, residential floors or commercial buildings to prevent moisture, mold and moisture. Damp proofing problems are one of the most frequent problems occurring in homes these days; they occur mainly in old buildings or poorly constructed buildings. Frequently damp proofing products keep the moisture away from the buildings, where vapor barriers retain internal moisture to the walls.

❖ **Causes of damp proofing in roofs:**

- ➢ It makes the poor quality of construction material.
- ➢ It has a bad design.
- ➢ Fault in construction.
- ➢ The rainwater falling on the outer walls & parapet causes moisture.
- ➢ If the roof of low quality, rainwater can also enter into the house.
- ➢ Small roof slopes or faulty junctions between roof slabs and parapet walls can cause damping.
- ➢ Leakage through down passes can cause moisture.

3.2.1. Down proof construction

The damp proof course (DPC) is generally applied at basement levels, which restricts the movement of moisture through walls and floors. The selection of materials for the damp proof course and its various methods of applications in buildings is discussed.

❖ **Properties of Materials for DPC**

An effective damp proofing material should have the following properties;

1. It should be impervious.
2. It should be strong and durable and should be capable of withstanding both dead as well as live loads without damage.
3. It should be dimensionally stable.
4. It should be free from deliquescent salts like sulfates, chlorides, and nitrates.

❖ **Types of Materials for Damp Proof Course**

The materials commonly used to check dampness can be divided into the following three categories:

- ✓ Flexible Materials: Materials like bitumen felts (which may be hessian based or fiber/glass fiber-based), plastic sheeting (polythene sheets), etc.
- ✓ Semi-rigid Materials: Materials like mastic, asphalt, or a combination of materials or layers.
- ✓ Rigid Materials: Materials like first-class bricks, stones, slate, cement concrete.

The choice of material to function as an effective damp proof course requires a judicious selection. It depends upon the climate and atmospheric conditions, nature of the structure, and the situation where DPC is to be provided the points to be kept in view while making selection of DPC materials.

3.2.2. Down proofing Construction Materials

1. DPC above ground level

For DPC above ground level with wall thickness generally not exceeding 40 cm, any one of the types of materials mentioned above may be used. Cement concrete is however, commonly adopted material for DPC at plinth level, 38 to 50mm thick layer of cement concrete M15 (1:2:4 mix) serves the purpose under normal conditions.

In the case of a damp and humid atmosphere, a richer mix of concrete should be used. The concrete is further made dense by adding waterproofing materials like Puddle, Emperor, Water lock, etc. in its ingredients during the process of mixing. It is used to apply two coats of hot bitumen over the third surface of the concrete DPC

2. DPC Material for floors, roofs etc.

For greater wall thickness or where DPC is to be laid over large areas such as floors, roofs, etc., the choice is limited to flexible materials that provide a lesser number of joints like mastic, asphalt, bitumen felts, plastic sheets, etc.

The felts, when used, should be adequately bonded to the surface with bitumen and laid with joints properly lapped and sealed.

3. DPC Material for situations where differential thermal movements occur

In parapet walls and other such situations, materials like mastic, asphalt, bitumen felts, and metal (copper or lead) are recommended.

It is vital to ensure that the DPC material is flexible to avoid any damage or puncture of the material due to differential thermal movement between the material of the roof and the parapet.

4.DPC material for Cavity Walls

In cavity wall construction, like cavity over the door or window should be bridged by flexible material like bitumen felt, strips or lead, etc.

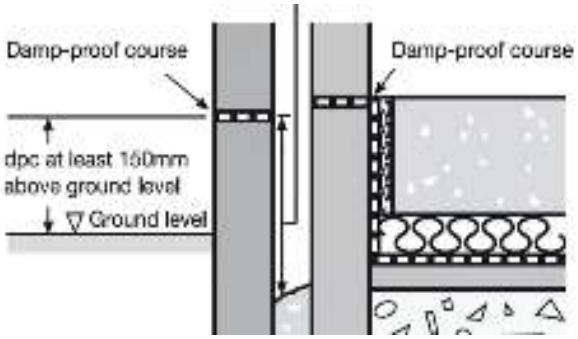

Figure 3.5 Cross section of Damp Proof Course

❖ **Methods of Damp-proof Course Installation in Construction**

1.The DPC should cover the full thickness of the walls, excluding rendering.

2.The mortar bed upon which the DPC is to be laid should be made level, even and free from projections. Uneven base is likely to cause damage to DPC.

3.When a horizontal DPC is to be continued up a vertical face, a cement concrete fillet 75mm in radius should be provided at the junction before the treatment.

4.Each DPC should be placed in correct relation to other DPC to ensure a complete and continuous barrier to the passage of water from floors, walls, or roof.

❖ **Properties of DPC material are-**

A. It should be impervious.

B. It should be strong and durable and should be capable of withstanding both dead as well as live loads without damage.

C. It should be dimensionally stable.

D. It should be free from deliquescent salts like sulfates, chlorides, and nitrates.

❖ **What are the types of DPC Materials?**

A. Flexible Materials: Materials like bitumen felts (which may be hessian based or fiber/glass fiber-based), plastic sheeting (polythene sheets), etc.

B. Semi-rigid Materials: Materials like mastic, asphalt, or a combination of materials or layers.

C. Rigid Materials: Materials like first-class bricks, stones, slate, cement concrete, etc.

❖ **The main causes of dampness in building:**

1.Moisture rising from the ground to the walls

2.Rain travel from wall tops

3.Rain beating against external walls

4.Condensation

5.Miscellaneous causes

6.Stones

7.Mortars

8.Cement concrete

9. Plastic sheet

❖ **Termite shields**

If termites are a problem in your locality, special shields should be provided. Termites live under-ground and come to the surface to feed on wood. The wood sill should be at least 8 inch above the ground. A protective metal shield should extend over the foundation wall.

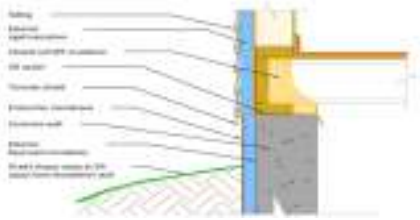

Figure 3.6 Shields

❖ **Installing Sills**

Two types of sill anchors are used, anchor straps or clips and anchor bolt. With the strap type, position the sill and attach the straps with nails. Some types must be bent over the top of the sill, other are nailed on the sides. When anchor bolts are used, remove the washers and nuts. Lay the sill along the foundation wall. Remember, the edge of the sill will be set back from the outside of the foundation a distance equal to the thickness of the sheathing.

Figure 3.7 Anchor strap used to anchor the sill and Anchor bolt in foundation

Draw lines across the sill on each side of the bolt. Measure the distance from the center of the bolt to the outside of the foundation and subtract the thickness of the sheathing. Use this distance to locate the bolt holes. You will probably need to make separate measurements for each anchor bolt.

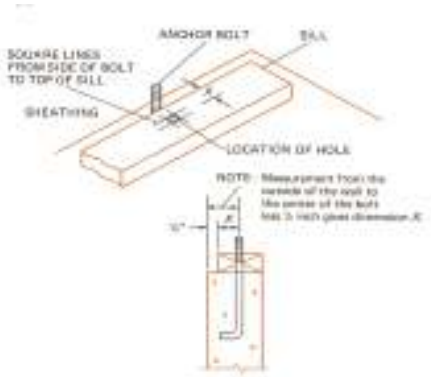

Figure 3.8 laying out the sill for anchor bolt

3.3. Perform Locate and fixe bearers

- **Bearers** are bolted to the post, piers or stumps; make a check with the spirit level, to see if the stumps are in the required height. Do not cut off the ends, this can be done later. Generally it will be found that due to the side bend of bearers, the rows of the posts or stumps will now be slightly out of line. Straighten this out when floor joists are fixed.
- **Joints**:-the lengths of timber land across the bearers are called joists. Joists should not be packed under to bring them to a level surface, but if a small amount of packing is needed on individual joists, this may be done with hardboard or plywood

❖ **Fit joists to level**

Trimming newel at bottom of outer string before fixing the bottom newel to the outer string the bottom end of the newel may need to be trimmed to the correct total rise or floor to floor site measurement. (Refer back to the section on cutting the wall string). Note: the bottom newel may not be at the bottom of the flight. There could be up to three additional steps to be fitted.

The methods below are generally suitable for board widths up to 135 mm, both overlay and structural flooring.

Figure 3.9 fixing beares

The secret fixing of boards requires one staple or cleat at the appropriate spacing. For (top) face nailing of boards through the sub-floor and into the joists, two nails per board are required at each fixing for boards exceeding 65 mm cover width. In humid and moist localities, additional care is required to cater for possible greater expansion. Consideration should be given to board moisture contents, providing for expansion, board size, and the species and fixing method.

In some locations top (face) nailing may be the preferred option or a full bed of adhesive used. Overlay flooring can be more reactive to changes in environmental conditions induced not only by conditions beneath the floor but also by sun exposure through large windows above the floor. Some manufacturers do not recommend that their 130 x 19 mm or wider boards be Secretly fixed and other manufacturers have specific fixing recommendations providing for the secret fixing of wider flooring that should be strictly adhered to. Installation of flooring should not proceed until other construction activities (particularly wet trades) are complete and until after the building is roofed and enclosed, with the temperature and humidity as close as possible to the expected in-service conditions.

As detailed above, expansion gaps of 10mm minimum should be provided at all walls and other fixed obstructions, which are parallel to the run of floorboards. Intermediate expansion joints should also be provided in larger floors (width at right angles to boards exceeding 6 meters), to give an equivalent gap of 10 mm every 6 meters (approx.1.5 mm every 800 mm) or alternatively the boards should be loosely cramped.

❖ **Secret fixing into sub-floor**

When relying on the sub-floor or substrate for fixing, boards should be secretly fixed with the first and last few boards that do not allow secret fixing, top (face) nailed. When laying over an existing T&G sub-floor the new flooring may be laid either parallel with the existing boards or at 90° to or at any other angle to the existing boards, providing the sub-floor (substrate) is within the required flatness tolerances. The fixing of the floor may be undertaken relying on a combination of mechanical and adhesive fixing.

When fixing boards with a maximum width of 85 mm at close centers up to 225 mm, beads of adhesive to provide a cushion between the two floors should be used to minimize possible squeaks. This is achieved by using a continuous bead of adhesive at 90° to board length, midway between fixing points. Where flooring adhesive is used to provide more of the fixing, staples or cleats may be spaced up to 450 mm apart with beads of adhesive at the fixing points and midway between. With wider flooring up to 135 mm, a full bed of adhesive with fixings up to 300 mm apart is applicable.

Due to the reliance on the adhesive to provide much of the fixing in this instance, it is important that the adhesive manufacturer’s recommendations for using the adhesive are followed. Surface cleanliness, flatness provisions and spread rate are all important. Further

information on adhesives is provided. For 19 mm thick flooring staples for boards up to 85 mm wide should be a minimum of 32 x 15 gauge and cleats should be a minimum of 32 x 18 gauge. For wider boards to 135 mm x 19 mm, 38 mm x 15 gauge staples or 38 mm x 16 gauge cleats are recommended. For overlay flooring which is generally up to 15 mm thick, 25 mm long fixings are commonly used for all widths. Fixing is also required within 50 mm of board ends, however if too close splitting at ends may occur.

Figure 3.10 fixing screws

❖ Recommended Fixing of T&G Flooring to Sub-floors of Plywood, Particleboard And T&G on Joists (1)

TYPE OF FIXING	BOARD SIZE	SUB-FLOOR on JOISTS PLYWOOD, PARTICLEBOARD or T&G
SECRET FIXING	T&G boards up to 85 mm in width and 19-21 mm thick	• 32 x 15 gauge staples or 32 x 18 gauge cleats at 225 mm centres and • Adhesive beads[2] to be provided midway between fixing points.
		• 32 x 15 gauge staples or 32 x 18 gauge cleats at 450 mm centres and • Adhesive beads[2] to be provided at the fixing points and midway between fixing points.
	T&G boards greater than 85 mm and up to 135mm wide and 19-21 mm thick	• 38 x 15 gauge staples or 38 mm x 16 gauge cleats at 300 mm centres with a full adhesive bed[3]. • Suitability of flooring for secret fixing to be checked with manufacturer.

Type fixing

1. Fixings may vary to some degree between locations due to installers' experience of local conditions.
2. Adhesive beads of 6 mm to 10 mm are often applied in a zigzag pattern
3. Full bed adhesive to be applied to the adhesive manufacturer's instructions.

4. For overlay flooring up to 15 mm thick a fixing length of 25 mm is commonly used.

Top (face) nailing into joists through the sub-floor (substrate) When structural 19 mm flooring is used, the floor should be top (face) nailed with 65 x 2.5 mm machine nails or 65 x 2.8 mm hand-driven nails through the existing floor and into the joists.

For Thinner overlay flooring, 50 x 2.5 mm machine nails or 50 x 2.8 mm hand-driven nails should be used. In all cases, continuous beads (6–10 mm approx.) of flooring adhesive should be provided at the joists and midway between them to provide a cushioning effect between the two floors. Board ends adjacent to walls should be fixed with flooring adhesive and nailed to the sub-floor.

❖ Installation of Strip Flooring over Plywood and Battens on Concrete Slabs

The methods below are generally suitable for board widths up to 135 mm wide. Use structural flooring on battens and either structural or overlay flooring on plywood. The secret fixing of boards requires one staple or cleat at the appropriate spacing. For top (face) nailing of boards to the batten, two nails per board are required at each fixing for boards exceeding 65 mm cover width. Fix boards wider than 135 mm to battens with two or three nails

In humid and moist localities, more care is required to cater for possible greater expansion. Consideration should be given to board moisture content, providing for expansion, board size, and the species and fixing method. In some locations, top (face) nailing to the battens may be the preferred option or a full bed of adhesive used on plywood sub-floors. Overlay flooring can be more reactive to changes in environmental conditions induced not only by conditions beneath the floor but also by sun exposure through large windows above the floor. Some manufacturers do not recommend that their 130 x 19 mm or wider boards be secretly fixed and other manufacturers have specific fixing recommendations providing for the secret fixing of wider flooring that should be strictly adhered.

❖ **Assessing the concrete slab**

Timber floors may be laid on battens or plywood over a concrete slab, or by direct fix. Direct fix to the slab is a more specialist field and appropriate professionals in this field should be consulted if considering this method. The following covers installation of T&G flooring on plywood over concrete or on battens over concrete. Prior to installation, ensure that the concrete is sufficiently level to accept the system. Where there is a deviation of more than 3 mm below

two high points in a slab within a 1.5 m length, a concrete topping (levelling compound), grinding or packing should be used.

❖ **Methods to lay timber floors over concrete slabs**

When floors are to be fixed over a plywood sub-floor, overlay or structural flooring may be used. When floors are to be fixed to battens at 450 mm centers, structural flooring (19 mm or thicker) is to be used. The plywood sub-floor or battens need to be at a moisture content within a few per cent of the flooring to be installed at the time of installation. Installation of flooring should not occur until other construction activities, particularly wet trades, are complete. The building should be roofed and enclosed with the temperature and humidity as close as possible to the expected in-service conditions. For secret fixing, one staple or cleat per board at each fixing is required. For top (face) nailing to battens, boards exceeding 65 mm cover width require two nails per board at each fixing.

As detailed above expansion gaps of 10 mm minimum should be provided at all walls and other fixed obstructions, which are parallel to the run of floorboards. Intermediate expansion joints should also be provided in larger floors (width at right angles to boards exceeding 6 meters), to give an equivalent gap of 10 mm every 6 meters (approx. 1.5 mm every800 mm) or the use of loose cramping. As an added protection against moisture from the slab (from slab edge effects, beam thickening, etc.) or minor building leaks a 0.2 mm Thick polyethylene membrane is recommended.

The polyethylene should be lapped by 200 mm, taped at the joints and brought up the walls (or fixed columns, etc.) to or above the intended to surface of the flooring. The polyethylene is then covered by the skirting. Note that fixings of plywood sub-floors or battens through the polyethylene are not considered to reduce the overall effectiveness of the membrane. An applied moisture vapor barrier over the slab may also be used to protect against possible slab moisture.

TYPE OF FIXING	METHOD	BATTEN TYPE	
		SOFTWOOD, CYPRESS, HARDWOOD (min size 35 x 70 mm)	High density[2] HARDWOOD (min size 19 x 60 mm)
SECRET FIXING 19-21 mm thick boards	Machine driven	• 45 or 50 x 15 gauge staple[3,4] and adhesive[5] to batten	• 32 or 38 x 15 gauge staple[3,4] and adhesive[5] to batten for boards wider than 85 mm and up to 135 mm
TOP (face) FIXING 19-21 mm thick boards	Machine driven	• 45 x 2.2mm T – head[4] or 50 x 2.5mm T – head • and adhesive[5] to batten	• 32 x 2.2mm T – head[6] and adhesive[5] to batten or • 38 x 2.2mm T – head and adhesive to batten optional
	Hand driven	• 45 x 2.5mm bullet head[4] or 50 X 2.8 mm bullet head • and adhesive[5] to batten	

Table Betten Type

Fixing recommendations – plywood sub-floors to concrete Slabs and flooring to plywood

Plywood sub-floors should be structural grade, a minimum 15 mm thick and with a type a bond. Plywood 12 mm thick in also used by floor installers but with this thickness greater consideration needs to be given to slab evenness and the possible perforation of moisture barriers beneath the plywood. Sheets may be installed in a 'brick' pattern or at 45° to the direction of the strip flooring with a minimum 6 mm gap between sheets and a minimum 10 mm gap to internal and external walls.

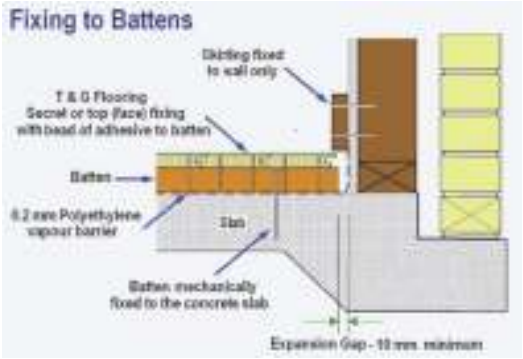

Figure 3.11 Fixing

Self-check -3	Question Related to Install Timber bearers

Part I Multiple choice

Instruction: Answer all the questions listed below. Use the Answer sheet provided in the next page: (2points each)

1 .DPC materials classified into

A.5 B. 4 C. 2 D.34

2 .Most residential and light commercial construction uses _____

A. Post-and-beam framing

B. Platform framing

C. Balloon framing

D. Braced framing

3. The lowest members of a structure's frame are _____

A. Joists
B. Beams
C. Sill plates
D. Soleplates

4._____ is installed between joists to stiffen the floor frame and disperse the load to neighboring joists.

A. Bridging
B. Sill plate
C. Girder
D. Rim joist

5. Damp proofing is done with a _____ based mixture.

A. Sand

B. Tar

C. Rubber

D. Lead

6 The main causes of dampness in building.

A. Mortar

B. Stones

C. Mortars

D. Cement concrete

E. Plastic sheet

7. Open and closed are methods of finishing

A. Rafters

B. Joists

C. Purlins

D. Eaves

8. The Primary functions of a Timber floor

A. Support the imposed loads of people and furniture.

B. Provide resistance to unacceptable heat loss through the floor

C. Correct type of surface to receive the chosen finish

D. Exclude the passage of Water and water vapor to the interior of the building

E. All

9. Flooring is generally supplied within the moisture content range from

A. 9% to 14%.

B. 5% to 15%.

C. 5% to 20%.

D. 0% to 15%.

Part -II Matching

Instruction: select the correct answer for the give choice. You have given 1 Minute for each question. Each question carries 2 Point.

A	B
---------1. Installing Sills	A. To mark the stumps and start cutting
---------2. Rigid Materials	B. Bitumen. fiber/glass
---------3. Join bearers	C To fix two pieces of timber with a nail gun.
---------4. Mark and cut the stumps	D. Bricks, stones, slate
---------4. Flexible Materials	E. Rolls and is then taped together.
---------5. Stumps	F. Concrete slab is paired with plywood
	G. floor is supported

Part III: Short Answer writing

Instruction: write short answer for the given question. You are provided 4 minute for each question and each point has two Points.

1. What is Properties of Materials for DPC
2. What are types of DPC Materials
3. What is perform its function a floor must satisfy
4. Secret fixing into sub-floor

Unit Four: Install Timber Floor Joists

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Set out location floor joists
- Identify material lengths for floor joists
- Floor joists for straightness,
- Block or herring bone strutting
- Fit and fix blocks/trimmers
- Cut, fit and fix trimmers

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Apply Set out location floor joists
- Select material lengths for floor joists
- floor joists for straightness,
- block or herring bone strutting
- fit and fix blocks/trimmers
- cut, fit and fix trimmers

4.1. Setting out location floor joists

Setting out to spacing from floor joists job drawings, specifications and regulations. This publication provides a reference guide for the installation of solid timber strip flooring over bearers and joists, timber-based sheet flooring products and concrete slabs. Generally, floors of this type are of solid timber or a laminated product made from layers of timber, bonded together. Flooring fits together with a tongue and groove joint. After the flooring is in place, the floor is sanded and finished. There are a number of other timber flooring products that are not of this type and are not covered by this guide. These include parquetry, prefinished floors and 'floating' timber floor systems.

When installing a strip timber floor, many aspects must be considered, including the house design, environment in which the floor is to be laid and the desired appearance of the finished floor. Such aspects influence the choice of species, cover width, fixings and finish to be applied. Information relating to product selection, assessing the installation environment, floor installation, sanding and finishing are provided in the guide, together with additional information of importance to the floor installer, sander and finisher.

https://youtu.be/km-6PyO7xCo?t=56

The Flooring Process Strip timber flooring is available in a wide range of species and colors, from harder and softer timbers and a variety of profiles and cover widths. Prior to the finished floor being handed over, there are a number of processes that must be correctly undertaken to achieve a floor with the performance and appearance that is of a professional standard. Each stage generally involves different sectors of the industry, each having specific skills. Each stage is of equal importance, with defined responsibilities.

❖ **How to Set out Floor Joist**

These run from the sill to the girder, which you place halfway between the outside walls and gives the ends of the joists a place to rest. It's important to lay out floor joists correctly. Measure the size of the area where you are laying out the floor joists to determine how many joists you need. Joists are generally 2 by 8 inch or 2 by 10 inch boards. Attach a header to the sill by standing a board on end so the wider part of the board is perpendicular to the sill. Toenail header to the sill. Cut joists by measuring from the header on one wall to the far edge of the girder. Repeat by measuring from the opposite wall to the other edge of the girder. Cut all joists.

Starting at one end, measure 15 1/4 inches from the wall to the outside edge of the first joist. Mark with a pencil. Attach the first joist with a joist hanger nailed to the header or toenail joist end into the header.Lay out joists by measuring 16 inches on center from the first joist you installed. Repeat the process to install the joists on the opposite wall. Install by using joist hangers or toenailing into the header and the other end coming to rest on the girder. Nail joists together where they lay side by side on top of the girder. Toenail nails into the girder to hold the ends of the joists in place. Make a double joist where you can construct a wall atop those joists.

❖ **Wood Floor Joists to a Cinder Block Wall**

Once sill plates and rim joists are in place, the builder cuts wood floor joists to size and runs them between the rim joists.

Measure across the top of each wall to determine the length of each wall's sill plate. Mark the length of the sill plate on the sill plate lumber with a pencil and use a framing square to lay out a straight cut across the lumber's width. Cut the sill plates to size with a circular saw.

Measure the positions and spacing of the anchor bolts protruding from the top of each wall with a tape measure. Mark the positions of the anchor bolts on their respective sill plates with a pencil; keep in mind that the outside edge of the plate must be flush with the outside face of the wall. Bore anchor bolt holes at each mark, using a power drill equipped with a wood-boring bit. Lay the sill plates over the bolts and onto the tops of the walls. Place washers and nuts onto each anchor bolt and secure the sill plates to the wall by tightening the bolts with an adjustable wrench. Measure across the installed sill plates to determine the length of the rim joists; the rim joists that will rest perpendicular to the floor joists stretch corner to corner and the rim joists that rest parallel to the floor joists fill the space in between. Mark the determined lengths on the rim joist lumber, use a framing square to lay out a straight cut, and cut the lumber to size with a circular saw. Lift one of the rim joists that will rest perpendicular to the floors joists and place the joist on top of the proper sill plate. Stand the rim joist on edge and position the rim joist's outside face flush with the outside edge of the sill plate and its ends flush with the ends of the sill plate. Have a partner help you hold the rim joist in position.

Use a framing nail gun to toe-nail the rim joist to the sill plate while holding the rim joist in position. Toe-nailing refers to driving a nail through rim joist and into the sill plate at an

approximately 30 degree angle. Although specific nail sizing and pattern varies according to building design and code requirements, rim joist must connect to the sill plate at least at each end and every 16 inches or 24 inches on center, according the two spacing of floor joists. Lift, position and toe-nail the remaining rim joists. Use a nail gun to connect the rim joists at each corner; drive nails through a rim joist's face into the butt of the adjacent rim joist.

Mark the position of floor joists on the inside face of the rim joists with a tape measure, pencil and framing square; remember, the floor joists connect to the rim joists that run from corner to corner of the cinder block wall. Refer to your blueprints or local building codes for floor joist spacing, typically 16 inches or 24 inches on center. Measure the distance between the opposite rim joists to determine the length of a floor joist. Lay out the measurement on a piece of floor joist lumber and cut to size with a circular saw.

Hoist the cut floor joist between the rim joists, resting the piece on top of the sill plate. Align the floor joist with the layout lines that indicate its position, and use the framing nail gun to end-nail the floor joist to the rim joist. End-nailing refers to nailing through the outside face of the rim joist and into the end of the floor joist. Measure, cut and install the remaining floor joists.

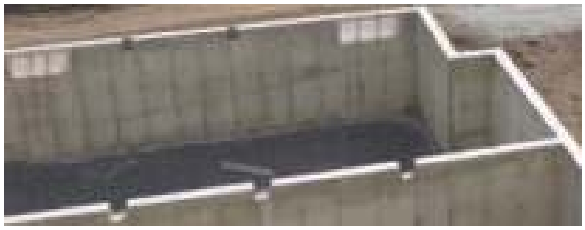

Figure 4.1Wood Floor Joists

❖ **Build a Basement Sub-Floor**

Seal existing floor, if concrete, and cover with felt paper. Seal walls with epoxy-based sealer before beginning sub-floor installation. Measure and cut 2-by-6-inch treated lumber to form a snug frame around the perimeter. Space the sleepers no further apart than 18 inches, splitting the difference on each end. Joist hangers can be used on the ends to hold the beams in place -- check with a level and tape measure constantly to ensure beams are plumb and level. Cut cross beams if necessary and install at 12- to 18-inch intervals, using galvanized 1 1/2-inch screws and staggering beams to allow room to maneuver. Drive nails in at an angle to secure to end beams. Continue checking for plumb and level until all sleepers are in place. Install sheets of plywood

by screwing flat or nailing to beams. Cut to fit around perimeter, and space fasteners close enough that there will be no possibility of buckling or warping.

Sand any rough edges, and fill gaps with wood putty. Seal with a moisture resistant barrier for extra protection. The sub-floor can now be covered with the desired flooring

- **Splice a Ceiling Joist**

Spread construction adhesive onto one face of each of the two 2-by-4s.Place one of the 2-by-4s on the side of the joist that is being spliced. Center the 2-by-4 over the crack or break in the joist. Tack the 2-by-4 down by putting a 4-inch-long screw into each end. Drive the screws in far enough to hold the 2-by-4 to the joist, but not so far in that they go through the other side of the joist. Put the second 2-by-4 on the other side of the joist so the joist is sandwiched between the two 2-by-4s. Screw this 2-by-4 to the joist with 4-inch-long screws, driving the screws all the way in so that they go through the 2-by-4, through the joist and into the opposite 2-by-4.Go back to the first two screws you drove in and finish driving them in so they go through the joist and into the second 2-by-4.Add more screws along the length of both 2-by-4s. The more screws you put in, the stronger the splice will be

Figure 4.2 Splice a Ceiling Joist

- **To Attach Rafters to Ceiling Joists**

Check the angle of the joists to ensure they are horizontal before attaching them to the rafter. Lay a water level on the top of the joist or check the angle with a laser level. If the joist does not sit perfectly level, then the wall heights must be corrected before the joists are attached.

Ensure that the ends of the joists that may project above the rafter are trimmed off before attaching the joists to the rafters. Use a table saw to cut off the angle that projects over the

rafter. Set the end of the joist on top of the wall (the other end of the joist should rest on the opposite wall). The trimmed edge of the joist should be up. Set the notched end of the rafter on the wall so that it sits flush with the top edge of the wall. Have a partner hold the rest of the rafter in place while you connect the joist and the rafter. The rafter and joist should sit flush against one another. Attach a seismic anchor to the side of the rafter opposite the joist. Seismic anchors are joints with a 90-degree-angle twist that connect the rafters directly to the wall.

Nail the joist to the rafter. Use at least four nails per joist/rafter connection. Nails should be at least one and a half times the depth of the rafter and joist beams. Usually, these beams are 2-inches by 4-inches, and so the depth is 2 inches. Thus, the nails should be three inch long wood nails. Test the rafter/joist attachment manually for stability by rocking it with your palm. For added stability, pre-drill holes for screws and anchor with 3-inch wood screws

Figure 4.3 Rafters to Ceiling

- **The measurement of Interior Door Header**

Step 1

Cut two 2-by-4 boards that are the same height as the doorway. These are called the jack studs.

Step 2

Nail the jack studs to the studs in the wall frame -- the king studs -- where you are installing the door.

Step 3

Measure the distance between the king studs, and cut two 2-by-4 boards to fit that distance. These boards will be the door header.

Step 4

Lay the two header boards flat on top of the jack studs and nail them to the jack studs.

Step 5

Measure the distance between the top board of the header and the top plate. The top plate is the top board in the wall frame.

Step 6

Cut a 2-by-4 board to fit the distance between the header and the top plate. This board is called the cripple stud. You can place the cripple studs to greater than 16 inches from either of the king studs, so cut more than one cripple stud if necessary.

Step 7

Place the cripple studs between the header and the top plate and nail them into position by driving the nails through at a 45-degree angle.

Figure 4.4 Intiror door

- ❖ **The stages of affect the finished floor**.
- ✓ **Manufacture** – Usually carried out by a saw miller, however, dried rough sawn boards may be machined into finished floor boards undertaken by a separate operation.
- ✓ **Distribution** – Flooring is often sold to timber merchants who on-sell to the installer.
- ✓ **Specification** – Architects, designers and owners usually specify the product to be installed.
- ✓ **Sub-floor** – Builders provide the joists and bearers or slab over which a floor is laid.
- ✓ **Installation** – Specialist floor installers and carpenters install floors over the sub-floor.
- ✓ **Sanding and Finishing** – Generally undertaken by professional floor sanders and finishers.
- ❖ **Laying out Joists**

Study the planes carefully. Note the direction the joists are to run. Also, become familiar with the location of posts, columns and supporting partitions. The plans may also show the center lines of girders. The position of the floor joists can be laid out directly on the sill. Joists must also be doubled around openings in the floor frame for stairways, chimneys and fire places. These joists are called trimmers. They support the headers which carry the tail (short) joists.

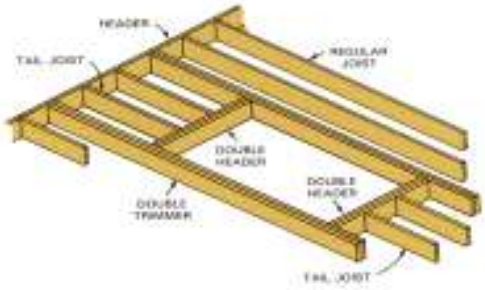

Figure 4.5 framing members are doubled around floor opening

❖ **Size joists use for floor**

The space between joists is typically 12, 16 or 24 inches. Joists that are closer together provide maximum support, those that are further apart may lead to unwanted bounce or sagging in a floor. Spacing joists at 16 inches off center is the most common measurement used in residential housing.

❖ **What Is Standard Floor Joist Size**

When it comes to floor joists, there is no standard size. Since joists form the support structure for a building, their size must be carefully calculated based on the load they will need to bear. Each separate measurement of a joist can vary and each of those variances will impact its stability.

- **Thickness** - Typically floor joists are 2 inches thick, although, for some spaces needing greater support, builders will double the thickness in order for the joist to take more weight
- **Width** - Floor joists range from 6 inches to 12 inches in width. Generally, the wider the joist, the further it can span without support and the more weight it can bear. However, it is not always possible to use the widest available joist as it can have a significant impact on the finished room dimension.
- **Length** - Joists can be of many different lengths depending on the placement of support beams, the width of the joist, the type of wood used and the spacing between one joist and the next.

4.2. Select material lengths for floor joists

Detailed below are typical domestic timber floor construction details – these details and span tables are not suitable for use with non-domestic situations, where the floor timbers must be calculated by a structural engineer due to the higher loadings carried. The following table gives

details of allowable spans and spacing between joists for the most common timber sizes used in floor construction. All the figures are based on normal domestic floor loadings where the floor construction is typically 18-25mm floor boards/sheets with up to 12.5mm thick plasterboard and skim underneath. For any other situation these tables may not be appropriate and you should refer to the Document – 'Span tables for solid timber members in floors, ceilings and roofs for dwellings'. When choosing a joist spacing, check that your floorboards (or sheets) are strong enough to span over the width chosen. As a general rule - floorboards should be a minimum 16mm thick for joist centers up to 500mm and 19mm minimum for centers up to 600mm.

FLOOR JOISTS SUITABLE FOR DOMESTIC FLOOR LOADINGS			
Size of joists in mm	Maximum clear span in metres for joist spacing of		
	400mm	450mm	600mm
97 x 47	1.93	1.82	1.47
120 x 47	2.52	2.42	2.05
145 x 47	3.04	2.92	2.59
170 x 47	3.55	3.42	3.00
195 x 47	4.07	3.91	3.41
220 x 47	4.58	4.39	3.82
145 x 75	3.54	3.41	3.10
170 x 75	4.14	3.99	3.63
195 x 75	4.72	4.52	4.13
220 x 75	5.15	5.01	4.67

Table floor joists

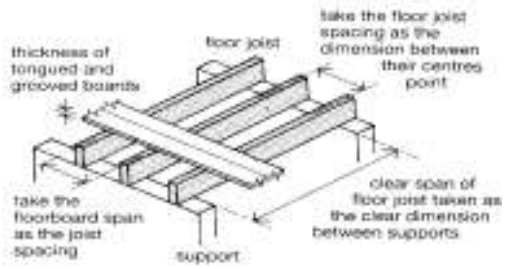

Figure 4.6 floor joists detail

When constructing timber floors you should also bear in mind the following points:-

1.Floors are used to give lateral restraint to walls, and where the joists run parallel to the wall, straps need to be installed as shown in the detail below. Normally these straps have to be positioned every 2m along the wall, but up to 3m is acceptable where this is to allow the formation of a stairwell or similar floor opening - provided additional straps are fixed each side of the opening. The galvanized mild steel straps must have a minimum cross sectional area of 30 x 5mm.

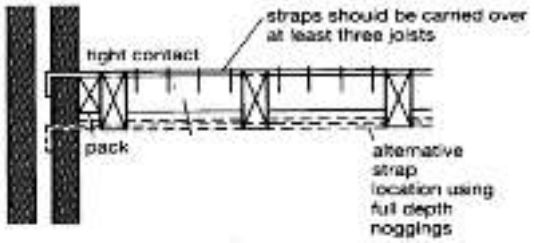

Figure 4.7 floor joists section detail

2. Around floor openings such as stairs, it will be necessary to install larger or double/ triple timber trimmers bolted together to carry the floor joists. With all joined timbers supported by fully nailed proprietary joist hangers.
3. Floor joists must also be doubled up and bolted together under timber partition walls, and in bathrooms due to the weight of a filled bath additional joists must be provided under the bath.
4. Where the joists span over 2.5m, strutting is required to prevent joists twisting when loaded. For spans of between 2.5 and 4.5 m one row of strutting is needed, at the mid span position. For spans in excess of 4.5 m two rows of strutting will be required, positioned at the one third and two third span positions. Solid strutting should be at least 38 mm thick timber extending to at least three quarters the joist depth e.g. 200 x 50mm joists would need at least 150 x 38mm timber used as strutting. Herringbone strutting if you are not using the proprietary galvanized steel systems, should be at least 38 x 38mm timber but can only be used where the spacing between the joists is less than three times the depth of the joist e.g. for a 150 x 50 joist, herringbone strutting can only be used up to a spacing of 450mm

❖ **Adequate sub-floor ventilation and a dry sub-floor space are a must for timber floor performance.**

If installing a secretly nailed floor over joists, the joists need to be seasoned timber or Cypress as secret nailing cannot be re-punched. If the joists shrink away from the floor, movement of boards on the fixings is likely to cause excessive squeaking. Top (face) nailed floors may be fixed into either seasoned or unseasoned joists. If fixed into unseasoned joists, the joists need to be of a species not exhibiting high rates of shrinkage and be in single or similar species. Species exhibiting high tangential shrinkage rates or which are prone to collapse or distortion should not be used unless seasoned. The potential effects of floor frame shrinkage require assessment prior to specifying or ordering unseasoned floor framing, and due allowance made in the building design and detailing. Similarly, after installation, the effects of both shrinkage and possible nail popping need consideration.

The top plane of the joists must be sufficiently flat to accept the timber floor and to provide finished floor appearance that also appears flat.

The allowable span of timber flooring is dependent on the timber species, density, grade, thickness and whether or not the flooring is end matched. The following table gives the acceptable joist spacing and maximum spans for various flooring products when fixed to timber joists. Maximum board span (the distance between where the timber is supported) needs to be considered in installations where flooring is at an angle to the joists, as this increases the board spans.

- **Flooring joists are selected material lengths.**
  - **Joists**

Floor joists are the basic framing members of floor framing that carry the weight of the floor between the sills and girders. In residential construction, they are generally nominal 2 inch lumber placed on edge. In heavier construction, steel bar joists are used. The most common spacing of wooden joists is 16 inch, on center.

  - **Floor lengths**

Flooring is generally supplied in random length packs up to 4.8 m in length. The average length is often between 1.8 m and 2.1 m. Packs of shorter overall length are also available from some suppliers to facilitate floors in high-rise buildings that require product to be taken to the appropriate floor by lift.

The minimum length for timber being fixed to joists is 900 mm, based on a 450 mm joist spacing. In some instances, if it is known that the floor will be laid over a structural sub-floor, then lengths shorter that 900 mm may be provided

➢ **Construction method**

Where the timber floor is to be sanded and polished (i.e. feature floor) fitted floor construction needs to be used. With this method, the timber flooring is installed after the roof cladding and external wall cladding are in place and the house is weather tight. This prevents initial degrading due to water and sunlight exposure, and reduces damage from trades during construction.

❖ **Sub-floor framing – bearer size, floor joist size and flooring spans**

The size of timber members used to support the flooring boards can be determined from AS 1684- Residential timber-framed construction. For end-matched flooring profiles, joists with a minimum thickness of 35 mm may be used. Where plain end flooring is butt joined at floor joists, 45 mm or 50 mm thick joists are recommended to reduce splitting problems at butt ends.

4.3. Measure floor joists for straightness

A Floor Joist may be defined as a timber beam that is perpendicular to the beam and parallel to the walls that is used for the purposes of providing a supportive framework for flooring.

It has a very essential role in the sub-floor structure because they convey the dead load of the furniture, flooring load, vibration of people walking and impact load.For the use of floor joists high-quality timber helps to provide durability, evenness of floor, and strength. This joist must be nearly placed and fixed in nature so that it easily carries all loads such as live load, dead load, impact load, and sagging of flooring, preventing bending, etc.

Figure 4.8 floor joints for straightens

❖ **Floor Joist load-bearing depends upon the various factors which are as follows:**

a. Grade of the timber or lumber.

b. Species of Wood.

c. Length of the joist span.

d. The load was placed on the floor.

e. Width of Timber Boards.

f. The thickness of Timber Boards.

❖ **Straightens a twisted joist**

Joists are an important structural support for the home. When a joist becomes twisted, it can cause issues with your flooring and foundation or other supporting systems of your home. The good news is that straightening out your crooked joists is quick and easy you just need to know how! The "how to straighten twisted rafters" is a question that has been asked before. The most common way to fix the issue is by using a jack and a block of wood. The easiest technique to fix a twisted or warped floor joist is to place a block between them, which should be the same size as the joists or slightly smaller. If the joist is not vertical, you may need to position the block at an angle and pound it into place to straighten it.

❖ **How can you straighten a twisted 2×4 in the same way**

Cut a stud that is about an inch shorter than the bent stud. Apply adhesive to one edge and clamp it to the deformed stud's side. 3 inch screws should be driven through the deformed stud and into the stretcher's side. To join the two studs, use as many screws as necessary.Why do floor joists twist, for example? The majority of hardwood floor joists go from wall to wall in a room. Longer spans are necessary in many areas, with occasional blocking between each joist serving as bridging or lateral support. Floor joists may flex and deform under the subfloor if they are not blocked, resulting in an uneven floor.

❖ **How can you straighten a warped 2×10 in this case**

I soak bent wood in water to straighten it. Alternatively, if you can't submerge them, soak them in a moist towel on the inside of the warp curve until they're straight. Once straight, replace the water formula with Elmer's white glue or water-based wood glue.

❖ **What can I do to keep my 2×4 from warping?**

1. To avoid warping, properly dry or cure wood.
2. Allowing partly dried timber to rapidly restore moisture is not a good idea.
3. Don't allow timber to dry too slowly (doing so could worsen any bowing and other warping)

4. Over drying timber may result in cracking, splits, and end grain checking.

❖ **Floor joints spacing**

The floor joist placement is done between 12″ to 24″ inches apart from the center, but it depends on the size of the floor joist timber size, building codes, and requirements of the design.

❖ **Calculation of joint size**

For example, if you had a floor in a room that span is 20 feet, you would divide the room span and get 10 feet. That means you need a depth of joist that will be 10 inches.

The Standard Size of floor joists is 2×8, 2×10, and 2×12 and you can choose your suitable floor joists as authorized by the municipalities code.

❖ **Type of floor joints**

a. Shaped Floor Joist

b. Solid Lumber

c. Open Web Floor Joist

❖ **Advantage floor joint**

- ✓ They are vertical members and work as a beam that shifts a load to the ground.
- ✓ They hold the structure.
- ✓ They are bearing the live load, dead load, and impact load.
- ✓ They are enough to convey the weight of whole new floors.

❖ **Dis Advantage floor joint**

- ✓ They are not suitable for large areas.
- ✓ they are not placed without the support of walls, columns, and beam
- ✓ They have more weight as compared to other trusses.
- ✓ They have a restriction on design and model.

Figure 4.9 Flooring joists straightness

4.4. Install block or herring bone strutting

❖ **Installing to deep floor joists where specified in accordance with regulations**

The methods below are generally suitable for board widths up to 135 mm, both overlay and structural flooring. The secret fixing of boards requires one staple or cleat at the appropriate spacing. For (top) face nailing of boards through the sub-floor and into the joists, two nails per board are required at each fixing for boards exceeding 65 mm cover width. In humid and moist localities, additional care is required to cater for possible greater expansion. Consideration should be given to board moisture contents, providing for expansion, board size, and the species and fixing method. In some locations top (face) nailing may be the preferred option or a full bed of adhesive used. Overlay flooring can be more reactive to changes in environmental conditions induced not only by conditions beneath the floor but also by sun exposure through large windows above the floor. Some manufacturers do not recommend that their 130 x 19 mm or wider boards be secretly fixed and other manufacturers have specific fixing recommendations providing for the secret fixing of wider flooring that should be strictly adhered to.

Installation of flooring should not proceed until other construction activities (particularly wet trades) are complete and until after the building is roofed and enclosed, with the temperature and humidity as close as possible to the expected in-service conditions. As detailed above, expansion gaps of 10 mm minimum should be provided at all walls and other fixed obstructions, which are parallel to the run of floorboards. Intermediate expansion joints should also be provided in larger floors (width at right angles to boards exceeding 6 meters), to give an equivalent gap of 10 mm every 6 meters (approx.1.5 mm every 800 mm) or alternatively the boards should be loosely cramped.

❖ **The purpose Herringbone**

Herringbone struts are a form of cross bracing typically found between floor joists. Bracing between parallel rows of joists helps them to stay in place and prevents them from twisting. Herringbone struts can be made of timber or pre-galvanized mild steel.

❖ **Specification of Herringbone**

Length: 480mm

Weight: 105g

Herringbone Joist Strut HB400 provides the means to prevent sideways movement or the buckling of joists, a simple alternative to the labor intensive traditional timber noggins. Made from galvanized steel EN 10346 DX51D Z275. Joint centers - 400mm, Strut length - 480mm. Meets bracing requirements for long span domestic floors. In the interest of safety all corners are rounded. Only three sizes are needed to suit all standard nominal joist centers. Only two fixings per end are required.

Installation

- Generally required in the center of the span when floor joists exceed 2.5 meters.
- Where spans exceed 4.5 meters two rows will be required at 1/3 and 2/3 of span.
- Holes should be nailed using 30 x 3.75 square twist nails or equivalent screws.

Figure 4.10 Herringbone

❖ **Secret fixing into sub-floor (substrate) only**

When relying on the sub-floor or substrate for fixing, boards should be secretly fixed with the first and last few boards that do not allow secret fixing, top (face) nailed. When laying over an existing T&G sub-floor the new flooring may be laid either parallel with the existing boards or at 90° to or at any other angle to the existing boards, providing the sub-floor (substrate) is within the required flatness tolerances. The fixing of the floor may be undertaken relying on a combination of mechanical and adhesive fixing. When fixing boards with a maximum width of 85 mm at close centers up to 225 mm, beads of adhesive to provide a cushion between the two floors should be used to minimize possible squeaks. This is achieved by using a continuous bead of adhesive at 90° to board length, midway between fixing points. Where flooring adhesive is

used to provide more of the fixing, staples or cleats may be spaced up to 450 mm apart with beads of adhesive at the fixing points and midway between. With wider flooring up to 135 mm, a full bed of adhesive with fixings up to 300 mm apart is applicable.

Due to the reliance on the adhesive to provide much of the fixing in this instance, it is important that the adhesive manufacturer's recommendations for using the adhesive are followed. Surface cleanliness, flatness provisions and spread rate are all important. Further information on adhesives is provided.

Sets out specific location requirements for timber blocking or strutting in floor framing. For ground floor joists, blocking is generally required along the lines of subfloor horizontal support, i.e. bracing lines. For other floor joists, blocking is required along the line of each braced wall in the story below. Blocking at the joist ends must be between the edge pair of joists, and then at 1.8 m centers maximum see Figure.

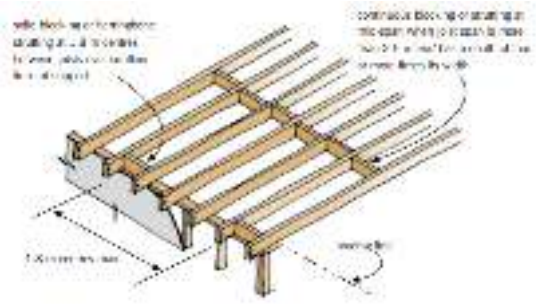

Figure: 4.11 Blocking or strutting location

Alternatively, a continuous 25 mm wide boundary joist, the same depth as the floor joists, can be used to provide that lateral support at the joist ends. In addition, clause 7.1.2.3 requires continuous timber blocking or strutting at mid-span when the joist span is greater than 2.5 m and the joist depth is four or more times its thickness. Blocking between joists may be achieved by: 40 mm wide, full joist depth, solid timber blocking cut between adjacent joists, or pairs of 40 x 40 mm diagonal timber herringbone struts fitted between the top and bottom edges of the joists in opposite directions between adjacent joists see Figure

Continuous solid blocking may be offset 50 mm for easier fixing.

If more than 150 mm from a joist, a nonloadbearing wall must be supported by 90 x 45 mm solid blocking cut between the joists with the top edge flush with the top edge of the joists. Blocking is required at each end of the wall, at either side of door openings, and at 1.2 m centers maximum.

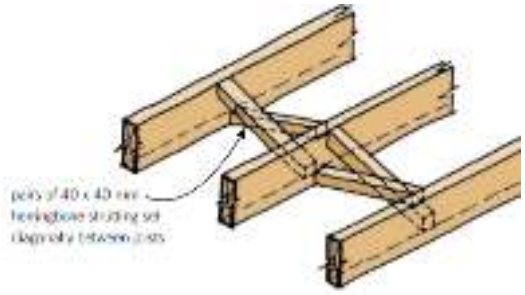

Figure: 4.12 Herringbone strutting.

❖ **Blocking not always required**

The requirement for continuous blocking or strutting at mid-span has not changed from the with a maximum spacing of 400 mm centers, may span up to 2.7 m, and grades with a maximum spacing of 400 mm centers, may span up to 2.9 m. For these sizes, the depth of the joist (140 mm) is not four times or greater its thickness (45 mm) so, under clause blocking is not required. Although limited in its application, and generally only applicable for ground floor framing, there is some advantage to keeping bearer centers such that 140 x 45 mm joists can be used.

❖ **Solid blocking versus herringbone strutting**

Solid blocking is more commonly used than herringbone strutting primarily because it is quicker to install. However, one advantage of herringbone strutting is that it is possible to tighten up gaps that occur in the blocking when timber shrinks.

If joists are installed wet, solid blocking that was originally tightly fitted will not be tight after shrinkage has occurred. If herringbone strutting is fitted, this can be tightened from the underside after the timber has dried in situ, and before linings are installed. If solid blocking is used, it should be fitted as late as possible in the construction process and with dry timber when joists have had more time to dry and shrinkage is reduced or eliminated.

Other benefits of herringbone strutting include the ability to run services without the need to cut or drill holes through solid timber, reduced timber waste as shorter offcuts may be able to be used (as long as minimum treatment levels are maintained), and when left exposed on the underside, it is more aesthetically interesting than solid blocking.

❖ **Herringbone strutting**

Herringbone struts area form of cross bracing typically found between floor joists. Bracing between parallel rows of joists helps them to stay in place and

prevents them from twisting. Herringbone struts can be made of timber or pre-galvanized mild steel. They are sometimes used as an alternative to solid block bridging (or noggins/drawings), particularly for long-span domestic floors. They are generally installed at the center of a span when floor joists exceed 2.5 m. Spans exceeding 4.5 m may require two rows spaced at 1/3 and 2/3 span. Timber herringbone strutting should be at least 38 x 38 mm timber and can only be used where the spacing between the joists is less than three times the depth of the joist. They may be the preferred option if there is a lot of pipework or cabling to accommodate between joists, as they reduce the amount of drilling that would be required through solid noggins, which would weaken the floor. A common problem in older dwellings is that floors feel 'springy'.

This can, in part, be because the herringbone struts have been removed in order to run services. Their re-introduction, or the reintroduction of regular noggins can help reduce the problem as the floor is encouraged to behave more as a 'slab' rather than a series of individual joists. Alternatively, and perhaps more reliably, the floor can be strengthened, by 'sintering' steel, timber or ply reinforcing joists to the side of the existing joists, although, perversely, the installation of reinforcement can be made more difficult by the presence of herringbone struts or noggins.

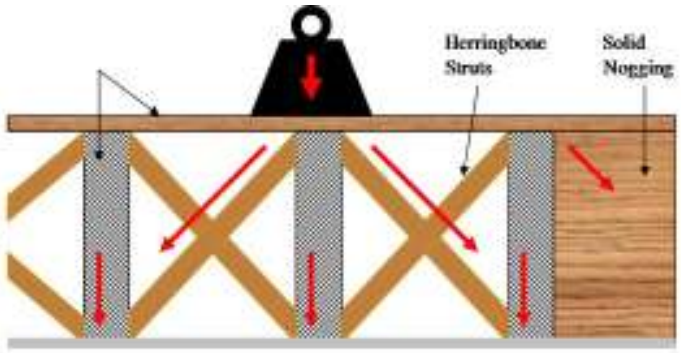

Figure 4.13 Herringbone

4.5. Conduct Fitting and fixing blocks/trimmers

Floor Joist blocking refers to installing solid lateral supports between two adjacent floor joists to evenly distribute loads imposed on joists from the floor above. Lumber with the same width of the joist is used for solid blocking between joists at mid-span of joist or at a spacing, not more than 8 feet. Blocking is done either in a straight line or staggered form. These blocks, sometimes

termed floor joist spacers, are installed between two adjacent joists perpendicular to the direction of the joists an

❖ **Joist Blocking**

A joist is highly susceptible to horizontal and vertical movement in the absence of blocking. A properly installed solid woodblock or floor joist spacer will distribute vertical loads across all joists. As a result, the movement of joists will be reduced. These wooden blocks prevent floor bouncing by distributing weight evenly across all joists. Lateral strength and floor stability can be increased by blocking the floor joist.

❖ **Reduces floor wobble**

- Installing process is easy and simple
- Low-cost solution for floor movement.

❖ **Cons**

- Blocking may create a 'Hump' in the floor due to different drying rates of joist and blocking.
- Require a high precision measurement to perfectly fit between joists.
- Existing electric and plumbing ducts can make the installation process strenuous.

❖ **Joist Blocking Methods**

A. Straight-line Joist Blocking

Straight-line blocking requires some expertise for correct installation. It is also good aesthetically, especially when the floor is exposed from the bottom. This works best if you can cut the blocks into shapes first. With that, you can initiate your installation from one side for blocking joists. Because the spacing between joists is often insufficient for a hammer swing, you will need to use a nailer. Nails are the best option for blocking or bridging. When compared to screws, nails provide significantly greater resistance to shear forces. Straight-line blocking provides one face of blocks for straight nail driving through joists. Toe-nailing of blocks is required, however, to connect the second face of the block to the joist. Two nails should be driven at a 45-degree angle from both sides when toe-nailing. Toe nailing reinforces the joints between joists and blocks. Consequently, straight-line joist blocking provides slightly more strength than alternate joist blocking.

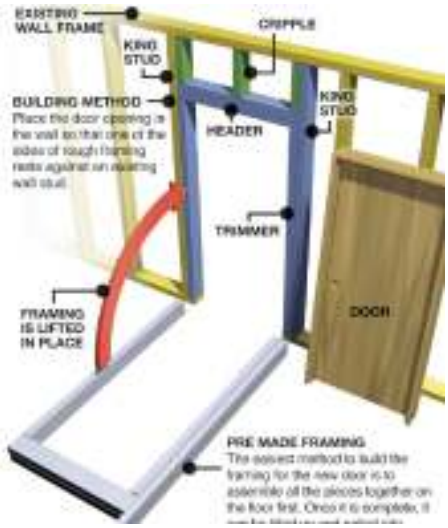

Figure 4.14 Straight-line Joist Blocking

B. Staggered blocking

In staggered joist blocking, also called altering, the blocking is laid asymmetrically. This makes it ideal for unexposed floors. In this method of joist blocking, you will get both faces for straight nail driving. No toe-nailing is required for staggered blocking of floor joists. Most people prefer alternate blocking of joists because it is easier, faster, and requires less degree of expertise in comparison with straight joist blocking. In case you want to perform altering, you have to simply draw a straight line across the joists. Now you have to place and fasten your blocks on either side of that line alternatively.

❖ **Joist Blocking Spacing**

According to the International Residential Code (IRC), joists with dimensions less than 2”×12” (thickness× width) are exempt from blocking. However, joists that are larger than this need blocking at a distance of not more than 8 feet. Blocking at 4 to 6 feet is generally preferred by various contractors. If you have an engineered floor joist or an I-joist, the floor joist bridging code of IRC recommends that you implement the manufacturer's instructions.

❖ **Alternatives to Joist Blocking to Reinforce a Floor**

If you notice that your floor is not firm and has some bounce, you can use other methods to reinforce it. Adding a sister joist is one of the options. In sister joisting, a second joist runs alongside the first joist and provides additional support and resistance to bounce. The only disadvantage of the sintering of floor joists is that you will require more space to install a new

joist. Sometimes the structure beneath might be fine, but the subfloor could be causing issues in your structure. Subfloor panels in old houses are prone to deterioration.

To rectify this issue, the best option is to lay a new plywood panel to replace the existing subfloor. The new layer of plywood will add extra thickness and significantly reduce floor bounce. You can also add a mid-span beam and some support columns to the joists. Placing a mid-span beam through half of your joists reduces the loads they were previously experiencing by half. If you're planning to build a new home, then consider a floor truss instead of a joist if you can afford the higher initial investment.

❖ **Is Joist Sintering the same thing as Blocking**

No, joist sintering and joist blocking are not the same. In joist blocking, an extra wooden piece is installed perpendicularly between two adjacent joists. This provides resistance against joists twisting which in turn reduces any bouncing of the floor. In joist sintering, an additional joist is installed just adjacent to a joist that is damaged. It is an additional identical joist for adding additional strength to the existing joist to hold floor weight efficiently

4.6. Cutting, fitting and fixing trimmers

Installing the pre-hung door will be breeze compared to cutting the opening for the door. If you had a concrete wall I would suggest that you hire a company that specializes in concrete cutting. Cutting cinder blocks will be a project but it can be handled in a weekend. The question is, where should you begin first, get a building permit, and second, determine your ceiling height. This is important because you need to know if you have the proper height for a pre-hung. Also check to see if the cinder blocks are below ground level and how many blocks will remain above the door (header area). Most likely you will need to take the blocks all the way up to the underside of the sill plate and only down far enough to be level with the finish floor in the basement

Start by putting up a temporary wall under and across the joists where the exterior wall will be opened up. Leave enough space between this wall and the cinder block wall so you have enough room to work. This project will require you to cut the wall on both the exterior and interior sides of the cinder block wall, so it is important to know the rough opening of the wall. To determine this, measure the overall width of the pre-hung doorframe and add 1/2" and another 6". (Your header will be this width measurement minus 3". The 3" is for the two studs that will be nailed to the ends of the header. The other 3" is for trimmers to be nailed to the studs

under the header to support it. The 1/2" is the space needed to adjust the pre-hung door using shims.) Take this measurement and mark it on the wall both on the exterior and interior sides. Use a straightedge to draw the cut lines and make sure that the cut lines are level and plumb and the measurements between them are the same. Take care so the cut lines land on the outside of the center support of the cinder blocks.

Hang plastic from ceiling to floor around the work area to help contain the dust. Now, make sure you are wearing safety glasses, hearing protection, and a mask when you begin this next phase of the project. Take a 4- or 5-pound hammer and punch about a 10" (or larger) hole in the wall to the outside in the center of the rough opening. This hole is necessary for fresh air and helps move the dust to the outside while you cut the wall. Then use a circular saw and masonry saw blade to score/cut the cut lines. Once the cut lines have been scored/cut on both sides, you can start breaking out the blocks. Take your time and be careful when breaking out the blocks near the cut line. You may need to use a masonry chisel to break any cinder blocks that are attached in the center of the block.

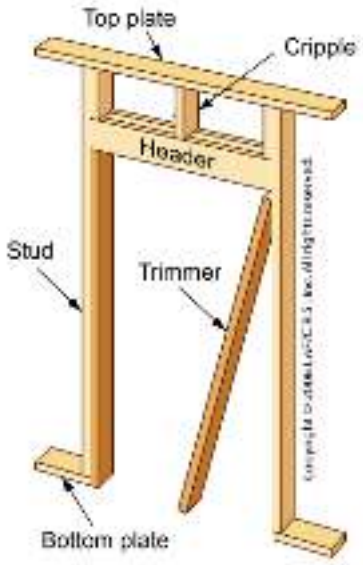

Figure 4.15 fixing trimmers

Once this area is clean, it's time to access the opening for framing. It is possible that your rough opening landed in the center of some cinder blocks. If this is the case, then concrete can be poured from the top into these areas, but you will need to build a form in front of these areas to hold the cement while it cures. The form can be supported by 2x material wedged into place

horizontally within the rough opening up against the form and the cut cinder block on the opposite side. You may need to form up both sides. Before you start this, do a quick double-check on your rough opening measurements. Before pouring any concrete is a good time to enlarge the opening if necessary.

The frame including the header can be pre-built and placed within the rough opening with the trimmers added last; however, before building the frame, temporarily attach your studs (2x) to the cinder blocks using lead anchors and at least 3 lag screws per stud. This will require a masonry drill bit and wood bit. Once you've done a trial fit, build your frame and reinstall the lag screws. The heads of the lags will stick out so you will need to drill a hole large enough on the backside of the trimmers in order for the trimmer to lie flat up against the studs. Consider using screws instead of nails and pre-drill when attaching the trimmers.

When completed, you will have a wide rough opening that will require jamb extensions unless your pre-hung door is custom-built to fit that width. As you install the pre-hung door, keep in mind that if the door is going to swing to the exterior side, the door's frame needs to be flush to the exterior wall. If the swing is to the interior side, then the door's frame needs to be flush with the interior wall. If your door is custom-built, it is already fabricated for the proper installation. If you are going to build your own jamb extensions, putting the door in either of these positions will prevent you from butting the jamb extension up against the hinges. It will force you to put the jamb extensions on the opposite side of the frame, where it is required.

Self-check -4	Question related to Install timber floor joists

Part I Multiple choice

Instruction: Answer all the questions listed below. Use the Answer sheet provided in the next page: (2points each)

1.Which of the following is not the stages of affect the finished floor

A. Manufacture

B. Installation

C. Specification

D. Distribution

E. None of the above

2. What Is Standard Floor Joist Size

A. Thickness 2 inches

B. Width 6 inches to 12

C. Length 4.8 m in length. Depending on the placement of support beams

D. All

3.Type of floor joints

A. Shaped Floor Joist'

B. Solid Lumber

C. Open Web Floor Joist

D. A and B

E. All

4.What are the Advantage floor joint

A. Hold the structure

B. Hey are bearing the live load, dead load, and impact load.

C. Enough to convey the weight of whole new floors.

D. Work as a beam that shifts a load to the ground

E. All

5. How to Set out Floor Joist

A. Measure the size of the area B. Attach a header to the sill

C. Cut joists
D. Starting at one end, measure 15 1/4 inches
E. Lay out joists by measuring
F. Nail joists together
G. All

5. In staggered joist blocking, also called_____?

A. Altering
B. Straight-line Joist Blocking
C. Blocking Spacing
D. Reduces floor wobble

Part II True or False

1.Floor joists are the basic framing members of floor framing that carry the weight of the floor between the sills and girders.
2.Herringbone struts are a form of cross bracing typically found between floor joists
3.The standard spans exceed 4.5 meters Herringbone Joist Strut 400mm
4.The Standard Size of floor joists is 2×8, 2×10, and 2×12 and you can choose your suitable floor joists as authorized by the municipalities' code.
5. Most likely you will need to take the blocks all the way up to the underside of the sill plate and only down far enough to be level with the finish floor in the basement

Part III short answer

1.What is Joist Blocking
2.The purpose Herringbone
3.How to Select material lengths for floor joists
4.What is by mean Alternatives to Joist Blocking to Reinforce a Floor
5.Build a Basement Sub-Floor

Unit Five: Install Flooring

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- floor materials
- Confirm floor measurements
- flooring materials
- Install and secure floor
- Complete Install flooring

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

Setting out location floor joists

- Apply Select floor materials
- Approve flooring measurements
- Perform cut and prepare flooring materials
- Apply Install and secure floor
- Implement Complete Install flooring

5.1. Flooring materials

Flooring Installers position the wood, tile, or carpeting and complete the installation, applying any finishing materials as needed. They are responsible for the whole project from start to finish as well as for job site safety and proper care of tools and materials.

Flooring Installers are problem solvers and craftspeople, determining the most efficient method to install flooring in a residential home or building. Depending on the size of the project, Flooring Installers work independently or as part of a larger crew. The first step is often meeting with the client to determine budget and goals. From there, they remove the current material on the floor, and clean the remaining work surface to apply an adhesive and possibly an underlay. Flooring Installers position the wood, tile, or carpeting and complete the installation, applying any finishing materials as needed. They are responsible for the whole project from start to finish as well as for job site safety and proper care of tools and materials.

https://youtu.be/cUryy5YmxHw?t=29

- **Floors**

Floors are the horizontal elements of a building structure which divide the building into different levels for the purpose of creating more accommodation within a restricted space one above the other and provide support for the occupants, furniture and equipment of a building.

- **Purpose of Flooring**

Affect the Design of Your Home: When someone walks into a room, the floor can affect their impression of a space subconsciously. Since the floor is underfoot and takes up so much real estate in any space, it has a significant impact on the aesthetic of your home. If you want to change the look of a room, change the floors. Flooring can make your space look instantly cooler, warmer, larger, smaller, more intimate, and cozier and more lux.

Improve or Hamper the Functionality of Your Home: Think about having an expensive and very delicate floor. Or, imagine rolling out of bed on a cool day and sinking your toes into silky-soft plush carpet. Your flooring directly impacts the way you experience your home. Flooring can affect acoustics in a family room or home office, letting you enjoy family time or work more. It can make it easier to walk around barefoot or in slippers. It can help you save on heating bills by making your feet warmer and more comfortable. Your floor directly impacts the way you behave in your home, which is why 50 Floor will always ask about your lifestyle, foot traffic, pets and other details to make sure you find the right floor options for you.

Impact the Health of Your Home: If you suffer from allergies or any condition that makes you aware of indoor air quality, you need to think about your floor choices. Some flooring is better at resisting the buildup of common allergens, such as particulate matter, dust and dander.

Determine How Much You Spend on Maintenance: Choosing floors that fit your lifestyle is essential, which is why 50 Floor will always ask you about your willingness to spend money and time on cleaning. Some flooring is specifically designed to be easy to clean, while some types are designed to last for a long time, so you don't have to redo your floors as often. If you have high-traffic areas or have pets or small children, for example, you may want to find a solution that is easy to clean and maintain and can handle some extra scuffing and activity.

Affect Your Home's Value: Beautiful floors make your home more inviting and can improve its value. They can even help make your space more attractive to buyers.

❖ **Types of flooring on basis of materials are:**

a. Mud flooring
b. Flag stone flooring or stone flooring
c. Brick on edge flooring
d. Wooden block flooring
e. Tiled flooring
f. Rubber flooring
g. Linoleum flooring
h. Cork flooring
i. Cement concrete flooring
j. Mosaic flooring or china mosaic tile flooring
k. Terrazzo flooring
l. Granolithic flooring
m. Magnetite flooring
n. Glass flooring
o. Marble flooring Plastic flooring
p. Asphalt or mosaic asphalt floor

https://youtu.be/6KEthELQfro?t=11

Upper floors

- An upper floor is basically a principal structural element, and the general structural design of a building greatly influence the choice of type of floor.
- Upper floors are supported either on the walls or on columns; they have therefore the major problems of strength and stability.
- The structural design of the of upper floors has to be such as to support:
  - The loads set up by the use of the building,
  - Self-weight of the floor,
  - Weight of partitions, etc.
- An upper floor can be constructed either from timber or concrete (Cast in situ and precast concrete).

- Upper floors are regarded to be composed of three parts:
  - The structural element,
  - Upper surface or floor finish, and
  - Lower surface or ceiling

❖ **Functional requirements of upper floors**

- An upper floor should:

1.Sustain its own weight and any other weights imposed on it.

2.Offer fire resistance especially in very tall buildings.

3.Minimise noise transfer from upper floor to the lower floor.

4.Be reasonably durable – minimum maintenance and replacement.

5.Provide an acceptable surface finish which is safe, comfortable, clean and of good appearance.

6. Prevent dampness.

1. Concrete floors (R.c.c. Floors)

- Floors of modern buildings are invariably made of reinforced cement concrete (R.C.C) for different advantages:
  - Moderately cheap,
  - Quite durable,
  - Easy to construct,
  - Fire proof and damp proof,
  - Can be used in large spans, etc.
- Based on the design requirements cast in situ concrete can be:
  - Simple slab flooring
  - Beam and slab flooring
  - Flat slab flooring
  - Waffle grid slab flooring
  - Drop slab floor
  - Ribbed or hollow tiled flooring

a) Simple slab flooring

- These slabs are quite suitable and economical for short spans and in most cases they are wall supported.
  - **One way reinforced slab** ($l_y/l_x > 2$). : The main reinforcement is placed in the direction of the shortest side.
  - **Two way reinforced slab** ($l_y/l_x < 2$). : The main reinforcement is placed in both directions.

a) **Simple slab flooring**

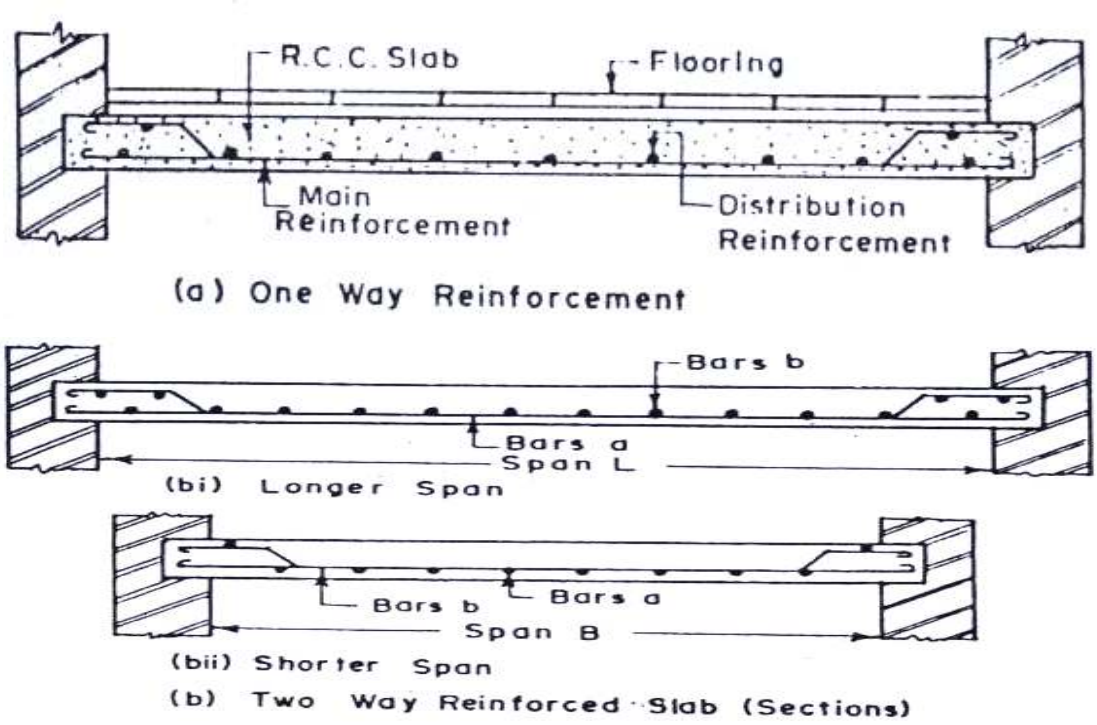

Figure 5.1 Simple slab flooring

b) Beam and slab flooring

- When the width of the room becomes more, the span of slab increases, and simple R.C.C slab becomes more uneconomical. In that case, the floor structure consists of R.C.C beams and slab cast monolithically.
- The beams known as T-beams, act as intermediate supports to the slab which is continuous over these beams.

- These types of floors are generally the most economic and most usual form of floor construction.

c) Flat slab flooring

- The slab is of uniform thickness throughout without down stand beams and with the reinforcement more closely spaced.
- The reinforced slab is monolithically cast with the supporting columns without any provision of beams.
- The flat slab transfers the load directly to the supporting columns suitably spaced below the slab.
- Used in case of large span and heavy loads.

d) Waffle slab flooring

- The intermediate cross beams are cast on a rectangular square grid that gives the underside of the floor the appearance of a waffle.
- The advantage of the intermediate beams of the waffle is they support a thin floor slab and reduce the dead weight of the floor.

This type of floor is used where a widely spaced square column grid is necessary and floors support comparatively heavy loads.

e) Drop slab flooring

A floor slab which is thickened between columns in the form of a shallow but wide beam.

f) Ribbed slab flooring

Advantages of ribbed slab:

- They are light in weight.
- They provide better thermal insulation.
- They have better sound proofing qualities.
- They have better fire resistance.
- Convenient installation of electrical and plumbing.

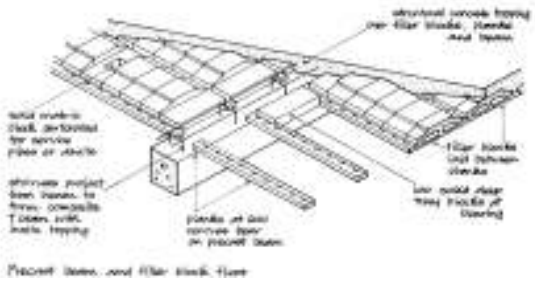

Figure 5.2 Ribbed slab flooring

A. Precast concrete floors

- Precast concrete floors are designed primarily with object of eliminating formwork and wet poring, which make the installation of an in situ floor rather a slow process.
- Precast concrete floors can be erected rapidly and immediately and they are lighter in weight.

Advantages

- Elimination of the need for formwork
- Curing time of concrete is eliminated
- Superior quality
- Erection at every weather condition

Disadvantages

- Less flexible in design terms
- Problems at connections
- Requirements for lifting device
- High degree of site accuracy is required

B. Brick flooring

- Is used in cheap constructions, especially where good bricks are available.
- Is especially suited for warehouses, stores, pedestrian walk ways, etc.
- Good quality bricks of various shapes and colors can be used.
- **Base course:**
  - Sub grade is compacted properly and a 7.5 cm thick layer of sand is spread.
  - 10-15cm thick layer of lean concrete is laid over the prepared sub grade.
  - Slopes shall be properly provided

- **Construction:**
  - Bricks shall be socked and wetted
  - The joints are rendered flushed and finished
  - The brick flooring shall be cured for 3-7 days to improve the durability

Figure 5.3 Brick flooring

C. Flag stone flooring

- Dressed stone having rectangular or square sizes or any shapes are used for making floors.
- Stone flooring can be used for garages, entrance corridors, pedestrian walkways, etc.
- **Base course:**
  - properly compacted ground or concrete base
- **Construction:**
  - Joints are pointed and cured
  - Provision of slope is necessary
- **Advantages:**
  - Hard, durable and resistant to wear and tear
  - Easy in construction and maintenance
- Not suitable in places like residential building or important public building.

Figure 5.4 Brick flooring

D. Cement concrete flooring

- Suitable for residential, commercial and even industrial buildings, laboratories, garage and ware houses.
- **Properties:**
  - Moderately cheap, durable and easy to construct
  - Moderately resistant to oil and weak acids
- **Components:**
  - Base concrete and toping (wearing) surface.
- **Construction:**
  - The components can be constructed monolithically or independently
  - Monolithically the topping is damaged during subsequent operation
  - Independently: base surface is covered with slurry, mix 1:2:4
  - In both cases the floor should be cured properly (at least for 7 days).

Figure 5.5 Cement concrete flooring

E. Granolithic flooring

- Granolithic finish consists of rich concrete made with very hard and tough quality coarse aggregates such as granite, basalt, quartzite
- Suitable where hard resistant to wearing and durable floor is needed.
- **Mix proportion:**
  - 1:1:2 to 1:1:3 for heavy duty floors
  - 1:2:3 for public buildings
- **Thickness of finish:**
  - Minimum of 25mm when laid monolithically with the top concrete

- Minimum of 35mm when laid over hardened surface.

➢ **Construction:**

- Shall be laid before the base coarse has set
- Surface is tamped and floated
- Smoothened by steel trowel

Grinding and polishing is done after curing

F. Tiled flooring

➢ **Suitable:**

- Residential houses, offices, schools and other public buildings

➢ **Properties:**

- Made of cement, clay, concrete or terrazzo
- Constructed in Square, hexagonal or other shapes and many colors.

➢ **Construction:**

- Similar to laying stone or brick floor
- Over a concrete base, a 25 to 30 mm thick layer of mortar is spread
- Neat cement slurry is spread over the bedding mortar
- Cement grouting of the joints
- The flooring need to be cured for 7 days
- Grinding and polishing

Tiled flooring

Figure 5.6 Tiled flooring

G. Terrazzo Flooring

➢ Terrazzo is concrete containing white and/or coloured cement and marble chips as an aggregate in proportion of 1:2 to 1:3.

➢ **Suitable:**

- Residential, Offices and other public buildings

- **Properties:**
  - Marble Chips exposed by grinding, may vary from 3-6 mm
  - Decorative and high wearing resistance
  - Can be found in market as precast terrazzo in the form of tiles (20-30 cm, t = 2-3cm) even for Stair Treads and Risers or as cast in situ.
- **Sub-base:** concrete base
- **Construction:**
  - Shall be casted with the required mix proportion
  - Grinding in three levels and then cement grout to seal holes
  - Mirror - Polishing

Figure 5.7 Terrazzo Flooring

H. Mosaic flooring

- Mosaic flooring is made of small pieces of broken tiles of china glazed or of cement, or of marble arranged in different pattern
- **Suitable:**
  - For Walls, Floors, Both internal and external, Stairs
- **Properties:**
  - Glazed or Unglazed
  - Impervious to water and have dense structure.
- **Types:**

- **Porcelain** - made by dust press method from ceramic materials with vitreous body, resistant to freezing and thawing and abrasive wear.
- **Natural Clay (Ceramic)** – made of natural clays or shale, which produce a strong

I. Plastic (Pvc) flooring

- It is made of plastic material, called Poly-Vinyl-chloride (PVC).
- **Suitable:**
  - For residential (bedrooms) as well as non-residential building
- **Properties:**
  - Fabricated in rolls or tiles with different colors
  - Resilient, smooth, good looking and cleanable
  - Easily damaged by heat or chemicals
- **Sub-base:**
  - concrete base (smoothly finished cement screed)
- **Construction:**
  - Adhesive shall be applied to the cement screed surface
  - Tiles are then pressed gently using lightweight rollers
  - Floor is washed with warm soap water

J. Marble flooring

- Marble flooring is one of the most expensive floor finishes.
- **Suitable:**
  - Residential buildings (Stairs, Corridor, Kitchens), Public and Worship places
- **Properties:**
  - Made of sedimentary rocks
  - Different sources – Granite, Marble
  - Durable, Water proof but expensive
- **Sub-base:**
  - concrete base
- **Construction:**
  - Similar to tile and terrazzo flooring

- Has to be cured and cleaned before use
- Mirror - Polishing

Figure 5.8 Marble flooring

K. Asphalt flooring

- Asphalt floorings are of many types and are used where wear resistance and durability are the main design factor.
- **Suitable:**
  - Mainly used in garages, stores,
- **Properties:**
  - Wear resistance and durable
  - Resilient, sound proof, non-absorbent and moisture proof
  - Used for basement floors, ground floors, floors exposed to external weather condition
- **Sub-base:**
  - concrete base
  - Wooden base (for asphaltic tiles only)
- **Types:**
  - **Asphalt mastic**: Made of sand and asphalt mixed hot and laid in continuous sheets.
  - **Asphalt Titles** – made of asphalt and other ingredients such as asbestos fibers, by pressing the mix in different sizes, with thickness varying usually from 3 to 6 mm.
  - **Asphalt Mosaic** – similar to mastic but made with marble chips in the place of sand.

- **Construction:**
  - The mix is poured on the concrete base
  - Spread by means of trowel to get a level surface
  - A thin layer of sand is spread which is then rubbed with a trowel
  - Asphalt tiles are simply glued to the base surface

L. Rubber flooring

- It consists of sheets or tiles of rubber, in variety of patterns and colors.
- **Suitable:**
  - Offices or public building like hospitals, schools, gym etc.
- **Properties:**
  - It is manufactured by mixing pure rubber with fillers such as cotton fiber, granulated cork or asbestos fire.
  - Resilient and noise proof however they are costly
- **Sub-base:**
  - Concrete base or wood
- **Construction:**

Figure 5.9 Rubber flooring

M. Cork flooring

- Manufactured by baking cork granules with phenolic or other resin binders under pressure.
- **Suitable:**
  - Areas where quiet and comfort are of paramount importance such as libraries, theaters, art galleries, broadcasting stations, etc.
- **Properties:**

- Perfectly noiseless
- They are available in various sizes, thickness, and shades [size= 10x10cm to 30x90cm, Thickness= 5 to 15mm]

➢ **Sub-base:**

- concrete base or wood

➢ **Construction:**

- Fixed to concrete base by inserting a layer of saturated felt
- By using fixing mechanism (suspended cork)

Figure 5.10 Cork flooring

N. Glass flooring

❑ This is a special purpose flooring used in circumstances where it is desired to transmit light from upper floor to lower floor.

❑ **Suitable:**

- Basement and upper floor where light has to be transmitted.
- Very costly and not commonly used.

❑ **Properties:**

- Structural glass, in the form of tiles or slabs (t = 12 to 30 mm)

❑ **Sub-base:**

- Steel Frames

❑ **Construction:**

- Suspended on closely placed frames
- Care should be taken to avoid joint failures

Figure 5.11 Glass flooring

O. Linoleum flooring

- Linoleum sheets or tiles are manufactured by mixing oxidized linseed oil in gum, resins, pigments, wood flour, cork dust and other filler materials.
- **Suitable:**
  - Except for Bath rooms, kitchens, etc
- **Properties:**
  - Seasoned in ovens for 2-4 weeks (given several coats of lacquer for greater stain and spot resistance)
  - Attractive, resilient, durable, cheap and easily cleanable
  - Subjected to rotting when kept wet or moist for some time
- **Sub-base:**
  - Concrete or wood base
- **Construction:**
  - Linoleum sheets are easily spread or
  - Fixed or glued to base in various patterns
- The sheets are either plain or printed.
- Available in 2-6mm thickness and 2-4m wide roll.

Figure 5.12 Linoleum flooring

P. Carpet flooring

- A textile floor covering consisting of an upper layer of "pile" attached to a backing.
- **Suitable:**
  - Passage ways, Bed Rooms, Hall ways
- **Properties:**
  - The pile is generally either made from wool or a manmade fiber such as polypropylene, and usually consists of twisted tufts which are often heat-treated to maintain their structure.
- **Sub-base:**
  - Concrete or wood base
- **Construction:**
  - Carpets and carpet tiles can be laid loose, stuck with a suitable adhesive or in the case of carpets edge fixed using special grip strips.

Figure 5.13 Carpet flooring

5.2. Flooring measurements

Before you drive to the nearest Home Depot to buy your flooring, you have to estimate how much material you actually need. You can do it in the following way:

https://youtu.be/IJwbac-AflM?t=2

1.Measure the room that you're going to install the floor in. We recommend measuring the length and width and rounding them up to the nearest inch. Make sure to always consider the widest point of the room, even if the walls are not perfectly straight.

2.Multiply the width by the length of the room to obtain the square footage. If your room is not rectangular, but has a more irregular shape, you could try determining its area with our trapezoid calculator.

3.Once you know the area of the room, you're good to go - this is the square footage of flooring materials you have to buy. If you want to cover the floor with square elements, the calculator can be helpful if you are interested what the biggest possible size of a single tile is.

4.If you're willing to put a bit more effort into the calculations, consider how much additional material to buy to account for waste during installation (for example to ensure that the patterns match on all pieces of flooring). We recommend adding 5-10% of the total area for that purpose.

❖ **How to estimate the flooring cost**

Once you know how much material you need, it's time to grab your wallet and drive to that Home Depot. Before you do it, though, you can spend a few more seconds to predict how much you're going to pay for the flooring.

All you need to do is determine the price per one square foot of your chosen material, be it hardwood, vinyl, or laminate flooring.

Example

To do so, use a tape measure to determine the room's length and width. Then multiply the length by the width to get your square footage. For instance, if the room is 12 meter wide and 12 meter long, you will need enough flooring for 144 meter square (12×12=144)

Figure 5.14 Flooring measurements

1. Measure the Width of Your Room

Use a tape measure and extend it from one wall to the parallel wall. To use our floor area calculator, be sure to note down this number in either meters or feet.

2. Measure the Length of Your Room

Measure the other two parallel walls in your room also using a tape measure. Make sure you note this down in the same dimension format as the previous step.

3. Multiply the Length of Your Room By The Width

Multiply the length by the width of your room. Use a calculator to make sure there are no errors and be sure to stick to one dimension type - metric or imperial. If you're struggling, You don't need to work out the total coverage of a room when using our calculator, however, if you want to, simply multiply the length and width measurements you have taken, and the result will be the area of the room. For example, if your room measures 9 feet wide by 14 feet long, your total coverage will be 126 square feet

4. Add 10% to Account for Any Errors

Use a room size calculator to add 10% to your final errors. This will account for any errors you may make when laying your floor and ensure you don't have to order more flooring or leave your floor unfinished until it arrives.

❖ **Flooring Calculator**

After you know your surface area, it's very straightforward. When you browse any type of Laminate Flooring at Factory Direct Flooring Ltd, each product has a flooring calculator on their page. Simply enter the surface area in either meters or feet squared and our laminate calculator will tell you how many packs you'll need and how much it will cost you. By simply measuring your room and entering your dimensions, we will provide you with an instant price which will show on every type of flooring you browse across our website. You can either input the total coverage or your width and length measurements, in meters or feet. Then sit back and let us do the work of calculating not only the cost but the room size and the number of packs you will need to order. You can even save your measurements room by room to make your shopping experience stress-free.

It also offers to add an extra 10% for wastage. While this may cost a little bit more, we highly recommend adding it just in case there are mishaps during the installation process.

My Project isn't just a laminate flooring calculator, it is a flooring calculator which works across all of our ranges of flooring. So whether you are looking at solid wood, vinyl or LVT, the My Project flooring calculator will have you covered. So whether you are wanting to work out the total cost of flooring you love, how many packs of flooring you will need to order or the measurements of your room in meters squared, the My Project calculator will assist your shopping experience in every way you need.

❖ **To Install Flooring**

After working out how much laminate flooring you'll need, and ordering the desired finish, it's time to take the first steps of the installation process. Prepare your sub-floor by ensuring it is clean and dry and has passed a moisture test. If not, allow your sub-floor at least 48 hours to acclimatize before installation.

Around this time, take your laminate out of its packaging and allow it to also acclimatize for at least 48 hours, so it doesn't expand once installed and lead to any peaks or gaps. It's recommended to install a Laminate Underlay prior to your laminate which will add insulation and a sound barrier for the room. Again, look at the dimensions of the underlay you'd like to use and ensure you have enough rolls to cover the width of your room. To install, underlay just needs to be simply taped together and at the seams.

Figure 5.15 Install Flooring

❖ **Which Direction to Lay Flooring**

Once your floor is prepared it's time to lay your laminate. However, the direction in which you lay the laminate can actually alter how the room looks as a whole. Generally, laying your floor in the same direction as the light source of the room is the favored direction. However, if your room is particularly narrow, then laying the floorboards across the room horizontally can

help widen the room. Vice versa, if you want your room to look longer, laying your floorboards lengthways can help.

Our laminate flooring simply clicks together thanks to their tongue and groove structure, so you needn't mess around with adhesives. Simply click each panel together and remember to leave an 8-10mm gap around the perimeter of the room to allow an expansion gap and space for beading or skirting.

Finally, install your beading or skirting using a hammer and nail or an adhesive. When purchasing beading or skirting, ensure the length will cover the whole perimeter of the room, again maybe add an extra pack for convenience.

5.3. Cut and Prepare flooring materials

❖ **Need for cutting rubber, vinyl, plastic or foam flooring**

Regardless of the flooring material, one should be equipped with the following items: a tape measure, washable marker, pen or pencil and a straight edge. These tools are the key to floor cutting and installation success. Why? Because these tools are your cutting safeguards. When used properly, they will help protect you from making any unsightly cutting mistakes. By staying vigilant in your measuring and marking, you will come away with clean edges and a perfect, tight fitting floor. It's now time to discuss the cutting tool. For the majority of flooring materials, such as rubber, vinyl and foam, all you are going to need is a sharp utility knife. However, this depends on the thickness and density of the material. If flooring material is too dense or hard to penetrate with a utility knife, a power or table saw will be required to make cuts. Here is a quick rundown of cutting tool requirements based on material:

https://www.youtube.com/watch?v=V7aeMUsULVU

❖ **How to Cut Plastic Tiles**

- Pretty much all plastic flooring can be cut with an utility knife. That being said, for hard plastics it is much more time and energy efficient to use a power saw. Plastic floor tiles are becoming increasingly popular overall all types over surfaces, including concrete basements or garages, outdoors over wood decks or flat roof tops. Some are even installed over grass, dirt or gravel.

❖ **How to Cut Rubber Flooring - Rolls, Mats and Tiles**

Cutting rubber can be done easily with a "sharp" utility knife and a 2x4 board underneath the cutting area. The thicker the rubber the more important it becomes to have a board underneath the cutting area, allowing the cut to open and reduce friction on your sharp utility knife blade. You don't need a saw for cutting rubber. In fact it will most likes make the process harder. Rubber flooring is most commonly installed over concrete and used for home and commercial gyms as well as many other commercial and residential spaces.

❖ **How to Cut Rubber Flooring, Vinyl, Plastic and Foam Flooring Materials**

1. Lay down your straight edge on the cutting line to use as a guide. Apply a decent amount of pressure to the straight edge in order to keep it in place. Doing so will help you keep your cuts from being jagged, crooked or wonky in any way.
2. If you're using a utility knife to make cuts, make a series of scores to for a clean cut edge.
3. For thicker foam tiles, go most of the way through and then fold the material and finish cutting the tile by following the fold with the utility knife on the opposite side of the tile.
4. For harder materials such as rubber or PVC plastic, making a series of cuts and then folding the tile is a more efficient way to cleanly sever the pieces than attempting to saw completely through the tile. Keep in mind the type of support system on the back side of the tile.
5. The easiest way to learn how to cut rubber flooring is to place a 2x4 board under the line you've marked for to cut, allowing the rubber to drape over the board. This will allow you to easily score the desired area without friction on your blade. As you score, the cut will continue to open until you are all of the way through
6. In some cases, such as harder plastics, even though you can make a clean break by folding, it can discolor the top surface from flexing around the supports. In these cases it is advised to use a power saw to prevent flex marks.
7. If you are using a power saw, make sure you are well-aware of safety guidelines and operation procedures. Always remember to wear eye protection when operating power tools, as small pieces can fly away.

5.4. Secure flooring

5.4.1. How to Secure Hardwood Floors

The technique flooring installers most often use to secure hardwood boards to the subfloor is called blind-nailing. Most boards have a tongue and groove, and nails driven through the tongue hold a board down while being hidden by the groove of the adjacent board. Special tools make the job of blind-nailing fast and relatively effortless, but certain circumstances may mitigate securing boards in this way. For example, it isn't easy to drive nails into a concrete subfloor, and you can't blind-nail boards milled without a tongue and groove. Gluing and face-nailing are alternative ways of securing flooring boards.

❖ **Securing the First Course**

- Lay out the first course along a prominent wall or down the center of the floor, depending on room layout and sightline. If you are flooring a single room, it's often easier to start along a wall, but if the flooring extends continuously from one room to another, you may prefer to lay the first course through a doorway and down the centers of adjoining rooms or hallways. If you start along a wall, face the tongues of the boards out.
- Glue or face-nail the first course to the subfloor. If you choose to glue it, cut away the moisture barrier under the course you are attaching with a utility knife and spread construction adhesive on the subfloor. Lay the boards on the glue and place weights on them to keep them down until the adhesive is dry enough to hold them, which usually takes about 24 hours.

Face-nail the first course as a time-saving alternative to gluing it. Drill evenly spaced holes in the faces of the boards with a 3/16-inch drill bit and drive a 2-inch ring-shank nail into each hole. Sink each nail head with a nail punch so you can fill the holes .

❖ **Blind Nail & Glue**

If you are installing your floor to a standard plywood subfloor then the blind nail and glue method is the best installation for you. You can use this method for pine, hardwood or reclaimed flooring if your floor was made with a tongue and groove edge, as seen below:

This allows you to blind nail the boards through the tongue and apply beads of glue to the back of the boards. Beads of glue are applied to the back of the boards with a caulking gun. Your

installer will determine what type of use, and how it will be applied either in a zig-zag or railroad ties. Some popular glue's for this method include PL-premium and Loba-Wakol. In some cases, your installer may use a full spread glue, which we will go over in the next section.

To blind nail, you will use T-nails or staples and a nail gun or pneumatic stapler. Your installer will determine which type of nail gun and nail/staple, and their size as part of the installation process. The nails are driven into the tongue of the boards so when the next board is set in place the nail is hidden. This is the most popular, and the most efficient installation method for Carlisle floors and can be used on solid wood flooring and engineered wood flooring.

❖ **Full Glue Down**

A full glue down installation is quite different from blind nail and glue. In this application method, the glue takes the place of your subfloor, nail, and glue of the previous method. The simplest way to visualize this process is to picture a paint being applied to a wall, as the glue is applied to the subfloor before the boards are set in place. Some popular glue down adhesives includes Bostiks Best, Mapei, Loba-Wakol, and Sika. The application methods for each of these adhesives will vary depending on the manufacturer, type of wood, subfloor, and installation conditions. You can use a full spread of solid or engineered wood flooring.

A glue down installation will be more time consuming. Typically your installer will come in on day one to install just the first row of boards in each room, then they must wait 24-48 hours, depending on the glue before they can proceed. This is due to the fact that the glue is applied in a thick layer and it will take time for the glue to cure and set up with the flooring boards in place. This installation method can also involve more equipment and creative carpentry to set and keep the boards in place while they set up in the glue. Because of this the glue down installation method can be more costly. However, if you were to factor in the cost of plywood, nails, and glue the overall average cost may be close to that of the blind nail and glue method.

❖ **Face Nailing**

Face nailing refers to a process of installing nails into the floorboards where they will be visible after installation. This method is derived from the earliest homes in the country where eastern white pine flooring boards, sometimes 40+" wide were installed. At the time, hand cut wrought iron nails were the only way to secure these boards to the floor joists and subfloor.

Although we have much more sophisticated installation methods available today, face nailing is still used on some flooring styles.

It is commonly assumed that if you use a board over 5″ wide that you must face nail the boards, or install plugs, to keep the boards flat. While that might be the case with lower quality hardwood flooring on the market, that is not the case with Carlisle floors. With Carlisle's higher quality standards, Slow Craft manufacturing process and proper installation methods, we have installed boards up to 20″ wide, with no face nails that are still flat and stable today. Face nailing does add more labor and cost to the installation so if your installer has recommended this for your new Carlisle floor speak with your specialist to make sure it is necessary before you proceed. The only time you must face nail is if your floor was made with a shiplap or square edge.

The decision to face nail a floor all depends on the overall look you want to create, your personal preference and the type/thickness of your subfloor. The most popular floor to face nail is our historic Eastern White Pine flooring, especially if you are trying to create a vintage or restoration style floor. You can also install antique cut nails in heart pine flooring but it will require pre-drilling prior to installing the antique cut nails.

❖ **Panel layout**

Secure Interior Flooring is a high performance structural floor, offering the robust feel of concrete with the speed of timber installation. It is engineered to address the complete range of performance needs for residential and light commercial floors. Secure Interior Flooring offers indoor comfort, quiet, solid floors and lasting peace of mind. Dimensionally stable, Secure Interior Flooring does not expand and contract from moisture or thermal movement making it the ideal substrate for wet area tiling or most floor finishes. When installed in accordance with its installation manual it achieves a serviceable life of 50 years. Secure Interior Flooring is made from 19mm thick fiber cement, giving you a stable and solid squeak free floor. Use as an interior flooring substrate under tile, vinyl or carpet over timber floor joists in both wet and dry areas.

❖ **Features and Benefits**

- Resistant to fire, rot resistant and resistant to moisture damage
- Can be exposed for up to 90 days during construction

- The tongue and groove joint removes the requirement for blocking, speeding up the install process
- Can be tiled directly without the need for underlay, avoiding noticeable height differences from one floor finish to the next
- Can be used as a lightweight undertenancy floor
- Can be gun nailed
- Classified as non-combustible material
- 15 year product warranty

❖ **Panel layout**

Secure Interior Flooring must always be installed across the floor joists with short sheet edges fully supported on joists. Secure Interior Flooring must be laid in staggered pattern.

1. No blocking is required under the tongue and groove joints.

When using the site cut sheet pieces, the minimum length of the cut sheet to be used must be 900mm or more.

All site cut sheets must be sealed with an acrylic sealer, similar that is compatible with the waterproofing membrane.

❖ **Tile and Vinyl Applications.**

The sheets are laid in a staggered pattern. Ensure the sheets are facing the correct way down depending on the final finish. Tiles or vinyl. Note:

1. Install sheet with label ‘This side down for tiles’ facing down.

2. Install sheet with label ‘This side up for vinyl’ facing up. Being 19mm thick, Secura Interior Flooring can easily be combined with traditional particle board or plywood fooring substrates.

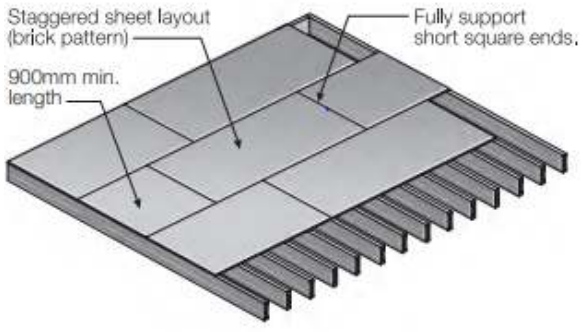

Figure 5.16 sheet layout

❖ **Installing step**

Installation Steps You must ensure the product is of acceptable quality prior to installation. The sheet is multi-purpose and depending on the finish, ensure sheet is laid with correct face upwards for the final desired finish. The Secure Interior Flooring must not be exposed to exterior elements for more than 90 days.

5.5. Install flooring

Laminate flooring is not hard to install yourself, even for beginners. In fact, after you're done installing your floors, you'll wonder why anyone ever pays professional installers for it.Unlike ceramic tile, laminate flooring installation is dry—no grout, no mortar, no adhesives that set up while you're working. And unlike solid hardwood flooring that needs to be nailed down, laminate snaps together and lies in place. Laminate flooring is a floating floor material that isn't attached to the subfloor or underlayment. Laminate installation is much like putting together a large puzzle and should take no more than one day for almost any room.

➢ **Before You Begin laminate flooring**

The best way to lay laminate flooring is to start with a subfloor or old flooring that's flat, smooth, and clean. You will need an underlay of foam sheeting for laminate flooring. Before beginning your laminate flooring installation, remove all baseboards and trim around the perimeter of the room as well as any heating resistors or air return duct covers mounted on the floor. Thoroughly sweep and/or vacuum the entire floor.

❖ **Tools and material for installing flooring**

Equipment / Tools

- ✓ Utility knife
- ✓ Hammer
- ✓ Tapping block or pull bar
- ✓ Rubber mallet (optional)
- ✓ Tape measure
- ✓ Straightedge
- ✓ Speed Square
- ✓ Pencil
- ✓ Circular saw, jigsaw, or handsaw
- ✓ Table saw (optional)
- ✓ Chalk box

Materials

- ✓ Laminate flooring
- ✓ Underlayment and tape
- ✓ Scrap wood spacers

❖ **Test the Flooring Layout**

Test-fit some laminate planks to see how they will lay out in the room. For a small to medium-size room, it's easiest to use the flooring itself rather than measuring and calculating. Arrange planks side by side across the room. You can lock the side joints together or simply butt the planks against one another; just be careful not to walk on the flooring if the joints are not locked together. Next, arrange a length of planks end to end. Be careful not to lock the planks together. This would create a lock that is difficult to undo and can damage the edges. Once you have a sense of the overall layout, pull up the planks and stack them in a nearby area.

❖ **Install the Underlayment**

Flooring manufacturers always recommend putting down underlay for laminate flooring. This thin, dense foam layer helps to absorb sound, provides a thermal barrier, makes it more comfortable to walk on the laminate, and helps bridge minor gaps and bumps on the underlying floor. Roll out sheets of underlayment, and butt the edges together so they are touching but not overlapping. Secure the seams with tape, as recommended by the manufacturer. Some underlayment's come with peel-and-stick adhesive edges that are used to join the pieces.

Using a utility knife, trim the underlayment to fit against the walls and obstructions.

❖ **Begin the First Row of Planks**

Trim off the tongues (not the grooves) from the boards that will edge the first wall. Often, this is easy enough to do with a sharp utility knife, or you can use a table saw or circular saw. Begin laying the first row on the longest wall with the trimmed edges of the planks against the wall. Start on the right side, and work to the left. Lay down a full-size plank against the wall, spacing it about 1/4 to 3/8 inch (as directed by the manufacturer) away from the wall and making sure the groove edge faces out. Place spacers of scrap wood between the flooring and the wall to maintain this gap.

Proceed with additional full-length planks, working toward the left to the end of the room. As you work, lock each piece to its neighbor using a hammer and a tapping block or pull bar to snug

up the joints. The end joints should be tight with no gaps. Some manufacturers suggest tapping the planks with a rubber mallet to help close the end joints.

❖ **Finish the First Row**

Once you reach the left end of the first row, the last plank will likely be too long. Measure the length needed and transfer that measurement to a full-size plank, measuring from the right to the left side so that the tongue end of the plank is preserved to attach to the last full plank. Be sure to account for the expansion gap at the wall. Cut the plank to length with a circular saw or jigsaw. Retain the cut-off end. This will form the first plank in the second row, beginning back at the right side of the room. Fit the final cut piece into the first row of flooring, and secure the tongue-and-groove end joint as before. A pull bar is particularly handy at the end of a row.

❖ **Plan the Next Rows**

Moving from right to left, the last piece in each row will always be cut off, with the cut-off piece from the left shifting down to begin the next row of flooring on the right.

The rows of laminate planks should have a staggered, saw tooth appearance so that seams never line up in adjacent rows. Not only would this be unsightly, but it would also compromise the structural stability of the flooring. It's best to keep cut pieces no less than 16 inches long. But with a stable, flat subfloor, the cut lengths can go as short as 1 foot. If you find that your first row leaves you with a very short cut piece on the left end, it's best to reconfigure the row so that it begins with a partial board on the right end. This will ensure that the cut plank on the left is an acceptable length

❖ **Continue Laying More Rows**

Install the planks for the second and subsequent rows, using a similar but slightly different technique than you used for the first row. For these rows, hold each piece at a 45-degree angle, and insert the long tongue edge into the groove of the planks in the preceding row. Then, lower the piece flat to the floor to lock the joint. Finally, tap the piece into its neighbor in the same row with the hammer and tapping block or pull bar (on all but the first piece in each row

❖ **Install the Last Row**

Unless you are very lucky, you will need to rip your last row of planks to finish the room's flooring installation. Mark planks in this last row for ripping, making sure to allow for the 1/4-inch expansion gap between the flooring and the wall. Rip the final row of planks using a circular saw, table saw, or jigsaw. Install the last row of ripped planks, using the same tongue-and-groove fitting technique. This can be a little tricky with the last row of planks because you

are working tight against the wall. But even in tight spaces, such as beneath a cabinet overhang, you should still have enough room to angle the board up to get it into a locking position.

Complete the installation by removing all spacers and then installing baseboard molding along the room's perimeter. The gaps along the walls should be entirely hidden by the molding.

❖ **A common mistake installing floor**

When laying laminate flooring is attempting to install it over an old floor covering, such as vinyl, that's soft or cushiony. This especially might be the case when installing laminate flooring in kitchens and bathrooms versus living rooms and bedrooms, as moisture in those areas might have caused the old floor to warp or become soft.

If the old floor surface has damage or unevenness, you likely will need to remove it. Then, prior to installing the underlay and laminate flooring, lay down a thin, rigid layer of plywood to serve as a flat, firm base.

❖ **The follow these steps to install floors in your home:**

Step 1: Acclimate Your Planks and Prep the Subfloor. ...

Step 2: Trim Door Jambs. ...

Step 3: Install Underlayment. ...

Step 4: Lay Your First Row of Laminate. ...

Step 5: Continue Laying Planks. ...

Step 6: Add Finishing Touches.

Self-check -5	Question related to Install flooring

Part I Multiple choice. Select the best answer and encircle the letter: (each points 2 mark)

1. It is a mixture of sand and cement with gravel, broken stone and other elements, which could be formed into a desired form.
   A. ceramic tile
   B. concrete
   C. granite
   D. marble
2. Hard floors include the following except one.
   A. ceramic
   B. bamboo
   C. granite
   D. vinyl
3. It is a mixture of sand and cement with gravel, broken stone and other elements, which could be formed into a desired form.
   A. ceramic tile
   B. concrete
   C. granite
   D. marble

4. _____are the horizontal elements of a building structure which divide the building into different levels for the purpose.
   A. Window
   B. Floors
   C. joists
   D. Bearer

5. Types of flooring on basis of materials
   A. Tiled flooring
   B. Rubber flooring
   C. Linoleum flooring
   D. Granolithic flooring
   E. All

6. Functional requirements of upper floors

A. Sustain its own weight and any other weights imposed

B. Minimize noise transfer from upper floor to the lower floor.

C. Prevent dampness

D. A&C

E. All

7. Cement concrete flooring not Suitable for

A. Residential building

B. Commercial building

C. Industrial buildings

D. Garage and ware houses.

E. None

8. Plastic flooring it is made of plastic material it is called.

A. Mosaic

B. Poly-Vinyl-chloride

C. Mortar

D. Bitumen

E. All

9. Marble flooring suitable for

A. Stairs,

B. Corridor,

C. Kitchens),

D. Worship places

E. All

10. Use a room size calculator Any Errors to add ___%

A. 10% to your final

B. 5% to you final

C. 15% to you final

D. 2% to you final

11. The technique flooring installers most often use to secure hardwood boards to the subfloor is called.

A. Screwing
B. Blind-nailing
C. fixing
D. Cutting

Part -II Matching

Instruction: select the correct answer for the give choice. You have given 1 Minute for each question. Each question carries 2 Point.

A	B
---------1. Concrete floors	A. Mostly use Passage ways, Hall ways
---------2. Marble flooring	B. special purpose light from upper to lower floor
---------3. Linoleum flooring	C. Most expensive floor.
---------4. Ribbed slab flooring	D. Rubber mallet
---------5. floor constriction tool	E. Quite durable
---------6. Cork flooring	F. Manufactured by mixing oxidized linseed oil in gum,
---------7. Glass flooring	G. Perfectly noiseless
---------8. Carpet flooring	H. Better sound proofing qualities

Part III: Short Answer writing

1.Give at least five types of floor.

2.Common mistake installing floor

3.How to Cut Rubber Flooring

4. What is by mean Asphalt mastic

5.Functional requirements of upper floors

Unit Sixe: Clean up

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Clearing work area.
- Reuse and recycle material
- Clean, check and maintain and Store tools and equipment

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Clear work area.
- Perform Reuse and recycle material
- Cleaning, checking, maintaining and storing tools and equipment

6.1. Clearing work area.

Preventive maintenance leads gathering dividends in service life through activities such as paint application will provide corrosion protection while enhancing also the appearance of the structure. The repair work consists of surface preparation / cleaning /, prime coating and finishes coating.

Using modern application techniques and preservative chemicals, steel structures can be effectively protected from corrosion.

Coatings: - encompasses three considerations

- Selection of coating systems,
- Removal of existing coatings
- Older paints that contain lead-based components must be removed cleanly and with the greatest respect for the environment and for worker health.

❖ **Removal technology includes:-**

- Electrochemical, deboning paint via low-voltage direct current;
- Plasma jet, ablating paint without distressing substrate

❖ **Replacement strategies**

- Painting should greatly extend the service lives of coatings.
- The paint systems incorporate zinc-rich organic and inorganic primers with urethane-based mid coats and top coats using moisture-cured media.
- Clearly, the most expensive option is the final one calling for complete removal, containment and repainting. Therefore it benefits an owner to do everything possible to extend the service life of the coating system in place prior to a remove-and replace effort.
- The most cost-effective effort is often to repair and overcoat the existing system. There are recognized methods for evaluating the condition of the existing system, and its suitability for over coating.

❖ **Data on the following are helpful in determining suitability:**

- The extent of corrosion or coating deterioration
- The number of coating layers and the total thickness of the existing coating
- The adhesion characteristics of the system in order to determine its suitability for over coating.
- The condition of the substrate beneath the coating(mill scale, rust or abrasive blast cleaned)

Experience has shown that a coating system can be upgraded by over coating if it shows deterioration/corrosion, has satisfactory adhesion.

Over coating or Recoating Material Selection:

Type of paint systems for over coating:-

There are several possibilities that have emerged after many years of laboratory and field testing. A list of some such materials is shown below:

- Alkyd (lead free)
- Calcium Sulfate Alkyds
- Epoxy Mastic/Urethane
- Moisture Cured Urethane
- Waterborne Acrylic

6.2. Reusing and recycling material

Cleaning site is much safer for the workmen than a dirty one and also used to construct the building components without problems (injuries) The preliminary site works for a construction project usually begin after the site facilities are set up.

Cleaning the site means.

- Removed all vegetation such as bushes and scrub
- The roots of trees and bushes must be dug out and cleaned away.
- Unwanted topsoil also removed.

The site (working area) needs t be clear of rocks and boulders in the area where the building will be set out. It they are too large, and then the boulders or rocks must be broken into smaller pieces and taken away.

Cleaning the site can be done by a combination of manual and mechanical methods.

Suitable arrangements for the safe disposal of waste materials must be provided. If possible, waste materials should be collected and disposed their source area. Where this procedure is impossible, these materials should be stared in a safe way (area) until they can be disposed of. Accumulation of waste should not be allowed where it will interfere with the operation of the machine or with the safety of the workmen.

❖ **Recyclability**

Recyclability measures a material's capacity to be used as a resource in the creation of new products. Steel is the most commonly recycled building material, in large part because it can be easily separated from construction debris by magnets. Many building materials that cannot be reused in their entirety can be broken down into recyclable components. Often, it is the difficulty of separating rubble from demolition that pre- vents more materials from being recycled.

❖ **Waste Disposal**

Store, and remove combustible waste products at the end of each workday or at the end of each work shift. Use only noncombustible containers to dispose of waste and rubbish and equip them with fitted or self-closing covers. Promptly remove and dispose of spills of flammable or combustible liquids. Place scrap lumber in containers and do not allow it to accumulate in work areas. Remove or bend over protruding nails unless the scrap lumber is placed directly in containers for removal. When choosing between waste minimization options, the following hierarchy for waste management is preferred:

- waste avoidance and/or reduction
- Reuse

Recycling Diverting the waste stream in these ways means that waste treatment and waste disposal options can be reduced. Plastering work sites should pursue this hierarchy and seek out waste reduction opportunities. To identify opportunities it is necessary to consider all aspects of the project and the wastes it generates. Waste can be minimized by using improved technology, recycled or reused on-site, or by making purchasing decisions that favor recycled products. Wherever possible, include performance measures and targets for reduction, reuse and recycling options in the environmental management plan

Cleaning tools are very essential to remove loose particles, dusts, grasses, etc. before and after using the tools and also from the formwork sheathing material. Some of these cleaning tools are:-

- ✓ Fiber brush
- ✓ Brooms

❖ **Waste minimization opportunities**

- obtaining construction materials, paints, lubricants and other liquids in reusable packaging or containers
- using noise barriers made from recycled materials

- Using overburden to construct temporary noise barriers.
- using contaminated water out of sediment dams for dust suppression and irrigating adjacent vegetated land
- sending waste concrete from demolition activities to a concrete recycler instead of landfill
- segregating and recycling solid wastes generated by construction activities, offices and mess-rooms
- collecting lubricating oil from the construction vehicle fleet and sending it to a recycle

6.3. Clean, check and maintain and Store tools and equipment

Hammerheads should firmly secure to the hand. Trowel, saws, chisels, and other tools should not be left lying on scaffolds, when not used.

All ropes and chains for lifting should be inspected before use they should not be loaded beyond the limit recommended by the manufacturer. Nails or bolts used in construction scaffold should be of adequate size of sufficient number at each connection to develop the designed strength of structure. Always get permission to use the machine. Inspect wood before planning, cutting, and remove any nails, dirt, or other things that will injure the cutting blade. Keep loose clothing, such as ties and sleeves, tucked in or rolled up. Never allow your fingers to pass over the revolving blades. Keep the safety guard in place and properly adjusted.

❖ **Maintaining plants, tools and equipment**

Tools and equipment used at the construction site undergo rigorous handling. From initial foundation development, to the final construction of the exterior trim, these tools are exposed to large amounts of dirt and abuse. Proper maintenance of construction tools and equipment is critical to preserving them for future construction jobs. Failure to maintain the tools properly results in unnecessary expense.

Clean the construction tools and equipment after each day's work. While a thorough cleaning is not required each day, a general wipe-down and removal of the heaviest construction dirt is key to extending the life of the tools. Lubricate air tools and pneumatic equipment before each day's use. Condensation in the airline creates an environment for corrosion inside pneumatic tools. Coating the internal components of these tools with air-tool oil will displace the moisture and prevent tool corrosion. Inspect and repair all construction equipment and tools at the completion of each job. Make all repairs to the equipment that is necessary for future construction work. This will prevent time being wasted repairing faulty equipment at future construction job sites.

❖ **Maintenance of Machinery, Plants and Equipment**

Activities of the Institute in this field is used in the electric power industry, ferrous and non-ferrous industry, metal processing industry, coal production, processing industry, etc..

The program of activities includes the following main groups of projects:

- Design and the introduction system of preventive and planned maintenance of plant and equipment,
- Introduction system of maintenance according to the determined state,
- Technological design for workshop for the manufacture and repair of equipment and spare parts for maintenance,

➢ **Designing, implementing and running system for preventive maintenance planning**

The program includes the following areas of work (projects):

- The organizational structure of the maintenance functions,
- A system of labeling systems and devices,
- System identification of spare parts, materials, tools and equipment,
- System for planning and management of maintenance work,
- Technology of maintenance work,
- Security procedures when performing maintenance,
- System planning and management of spare parts, materials, tools and equipment,
- System planning and management of workshops for the production and repair of equipment and spare parts for maintenance,
- A system of technical documentation management,
- Planning and managing of maintenance costs.

➢ **Introducing of maintenance system according to the technical condition**

The main objective of this program is to rationalize the maintenance process - especially improving technology maintenance. Setting the concept of maintenance is carried out by applying the methods of monitoring:

- Visual monitoring of the plant,
- Monitoring noise and vibration
- Monitoring the thermal state of the facilities,
- Controlling of the state of oil and lubricants
- Monitoring the insulation of electrical machines,
- Monitoring the mechanical stress conditions

- Detection of cracks and other damage of metal parts (magnetic flux, eddy current, ultrasonic, radiography, etc.).

Self-check-6	Question related to Clean up

Part I Multiple choice Select the best answer and encircle the letter: (each points 2 mark)

1. -------is contribute to more sustainable development by eliminating or reducing waste
   A. Recycling
   B. Technology
   C. Learning
   D. All of the above
2. What is the advantage of reusing and recycling construction products
   A. Avoids waste
   B. Reduces waste
   C. Saves primary resources
   D. All of the above are correct
3. Which one is true about clear area?
   A. It will be benefit by providing safe working area
   B. Expense will be saved
   C. The working area and learning classes will be a better place in which to work
   D. All of the above
4. What is the dis advantage if someone left Keeping Floors Clean
   A. It will be attractive
   B. It will be good for working
   C. It will be caused of people falling
   D. All of the above
5. The important of disposing and storing waste material.
   A. environmental cleanup C. Proper Waste Disposal and the Government
   B. Proper Waste Disposal and Environmental Health
   D. All
6. ---------- is removing unwanted Flooring materials
   A. Clearing work area
   B. Recycling material
   C. disposing
   D. Keep Aisles Clear

Part II: Short Answer writing

1.Why we dispose waste materials?

2.Mention at least two points about the advantage of cleaning of tools and equipment?

3.Write the benefits of recycling of waste materials

4.Define the terms dispose, reuse and recycle of material

5.Disposal methods adopted depend on the nature of the material.

6.Recyclability measures a material's capacity to be used as a resource in the creation of new products.

7.Waste Disposal Collect, store, and remove combustible waste products at the end of each workday or at the end of each work shift.

8.Maintenance is not before every use look for signs of damage to blasting equipment and power tools.

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