

CHAPTER 16: BUILDING WORKS

16.1 Introduction of the Unit of Learning

This unit describes competencies required to carry out building works. It involves executing site preliminary works, building temporary works, substructure works, superstructure works, building finishes and external works.

16.2 Performance Standard

Execute site preliminary works, building temporary works, substructure works, superstructure works, building finishes, and external works as per standard construction procedures.

16.3 Learning Outcomes


16.3.1 List of Learning Outcomes

- a) Execute site preliminary works
- b) Execute building temporary works
- c) Execute substructure works
- d) Execute superstructure works
- e) Execute building finishes
- f) Execute building external works

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16.3.2 Learning Outcome No 1: Execute Site Preliminary Works

16.3.2.1 Learning Activities

Learning Outcome No 1: Execute Site Preliminary Works	
 Learning Activities	Special Instructions
1.1 Survey the building site 1.2 Determine site boundary 1.3 Hoard/screen building site 1.4 Demolish unwanted structures 1.5 Clear building site 1.6 Prepare site layout 1.7 Prepare site preliminary report 1.8 Identify site <i>utilities</i> 1.9 Construct storage facilities	<ul style="list-style-type: none">• Be able to demonstrate how to prepare a site preliminary report• Conduct required practical works on site

16.3.2.2 Information Sheet No16/LO1: Execute Site Preliminary Works



Introduction to learning outcome

Building works need to follow a certain procedure of which site preliminary works forms the first step. This is crucial because if not undertaken then the success of building works is compromised.

Definition of key terms

Site utilities – These are services provided during construction that are essential for the normal functioning of the society. They include among others water, electricity and sewer system.

Surveying methods - These are techniques used to determine the relative position of objects on the earth surface for construction site investigation. These methods include plane surveying and geodetic surveying

Site installation - This is the erection of equipment and infrastructure such as power network equipment on site.

Content/Procedures/Methods/Illustrations

1.1 Survey the building site as per standard construction procedures

Surveying a building site is a process which comprises of assessing the suitability of the area of land for the building construction or other civil inferring works. The process involves taking note on key factors affecting the design of the building and security of the surrounding land. The main objective of the survey is to establish if the proposed building is feasible in technical terms and evaluate its economic benefits. In civil and construction works, surveying is done by making measurements relative to known or assumed datum for location, design and construction of civil engineering projects.

Other objectives include identifying different factors which cause difficulties in construction to aid in coming up with the best strategy and aid in coming up with a satisfying and economical building design.

Commonly used surveying instruments are;

- Theodolite
- Measuring tape
- Dumpy level
- Rod
- Electronic distance measurement
- Total station
- Automatic level

Procedure of surveying a building site

- i. Carry out reconnaissance- involves examining the survey area to know the best possible ways of carrying out surveying, establish a system of horizontal controls and make a sketch showing the permanent features including the north line.
- ii. Field measurements- the surveyor uses the surveying instruments to make linear and angular measurements.
- iii. Field record- all the measurements are recorded systematically on a field book. the records may be numerical value, written notes or even sketches.
- iv. Office work- the surveyor carries out drafting, computing and designing using the values recorded.

1.2 Determine site boundary as per standard construction procedures

A site boundary is a temporally line, limit or a margin erected to define the perimeter of a construction site which is used to manage the public risk in a construction site.

The following factors are considered in site boundary identification and sizing;

- Population density of the area- in an area where the labour forces is scarce, there would be a need for more living facilities in the site. Also, in areas where the happening far from the industrial centers, there would be a need for more space for equipment maintenance and storage area.
- Project size - a project taking a lesser period would need less site space compared to a project taking a period of 10 years which would need a temporally structure of a permanent nature.
- Nature of the project - an industrial plant project would need more space for mechanical and electrical works compared to a highway project.
- Nature of the site – the land scape and existence of another site before

1.3 Hoard/screen building site as per standard construction procedures

This is an area marked by a boundary that is used to keep the members of the public from construction site hazards.

Some of the holding materials include the following;

- Wood
- Steel
- Aluminum
- Chain- link

Importance of holding and screening building site

- To separate the public and the work site
- To protect the public from hazards like falling objects
- To keep the building floors protected during site visits and before handing over the project

1.4 Demolish unwanted structures as per standard construction procedures

This is to bring down a structure to pave way for a future installation.

There are various methods of demolition of unwanted structures. They are as follows;

- Manual method
- Demolition by use of a machine from top to down
- Demolition by implosion
- Demolition of floor slabs
- Demolition by crane and a wrecking ball

Safety considerations during demolition of unwanted structures

- a) Each employee should be equipped with the safety boots and helmets during demolition for their safety.
- b) The building should be inspected before demolition to ensure that no single person is left in the building during demolition and also assign someone to guard the area from entrance by unauthorized persons.
- c) Ensure the employees taking part in demolition are trained and experienced in the field.
- d) After demolition is complete, clean up the debris which could be harmful to the safety and health of the public

1.5 Clear building site as per standard construction procedure

Clearing a building site includes removal of trees, unwanted infrastructure and of obstacles that may hinder construction of an infrastructure.

Tools and equipment used in clearing a building site are as follows;

- Tractors
- Bulldozers
- Backhoe
- Axe
- Wheelbarrow
- Rakes

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Steps followed in clearing a building site

- i. Clear the undergrowth vegetation for example; grass
- ii. Cut down trees
- iii. Remove tall stumps by use of machinery
- iv. Remove the roots
- v. Remove and relocate large stones
- vi. Destroy the animal burrow by digging them out and fill them with clay
- vii. Clear the vegetation near the surrounding of the building site

1.6 Prepare site layout as per standard construction procedures

Site layout is the detailing of the site by sizing and erecting temporary facilities for efficient flow of materials. A good site layout should increase the output and ensure safety and maximize the area used for temporary constructions.

Procedure of preparing a site layout plan

- i. Gather information on site facilities to be required
- ii. Get the measurements of the infrastructures to be constructed

- iii. Determine how the different facilities in the site are inter- related
- iv. Maximize the use of the site area

1.7 Prepare site preliminary report as per standard construction procedures

The following steps show the steps in preparing a site preliminary report;

- i. Describe the project components which include the nature of the project.
- ii. Verify the project components
- iii. Prepare a site layout plan
- iv. Conduct a feasibility study of the site
- v. Identify the mode of payment of the project
- vi. Determine the number of construction contracts needed
- vii. Give a detailed opinion of the engineer

1.8 Identify *Site utilities* (Temporary washrooms, Source of water, Storage, Site office) as per standard construction procedures

Site utilities are- These are services provided during construction that are essential for the normal functioning of the society.

Temporary washrooms- number of toilets is better to be not less than the ratio of 25 people per toilet and reasonable allocation should consider the male to female ratio in construction area (Yang, 2017)

Source of water- water systems are highly regulated in building industry. All components of water used in construction must meet the requirements of building codes.

Storage- there should be adequate space, protection and control for materials and equipment that are to be kept in a construction site. Storage facilities will depend on the type of materials and equipment and their size.

Site office-office accommodation arrangements are a matter of choice for each individual contractor. Separate offices can be provided for site agents, clerk, administrative staff, site surveyor, secretary among others.

1.9 Construct storage facilities as per standard construction procedures

Storage facilities in site provide adequate space for protection of materials, equipment and other valuable objects on site a good storage facility should be secure, affordable, and has enough space for storage.

The storage area can be calculated using the formula below;

$$\text{Storage area } A = \left(\frac{Q_{\max}}{I_m}\right) / Q_n$$

$$Q_{\max} = q_{\text{daily}} \times t \times k, \quad q_{\text{daily}} = \frac{Q_{\text{total}}}{T}$$

Q_{\max} : Maximum estimated quantity in storage space; I_m : Utilization index for materials;

q_n : quantity of materials can be stored per m²;

T_{total} : Total quantity of materials required for the project;

q_{daily} : estimated quantity required per day;

T : construction period (not total project duration);

t : Average stock (days);

k : Fluctuation factor

Conclusion

This learning outcome covered the competency of executing preliminary works that are required in building works.

Further Reading



Watch various videos on how various tools and equipment are used in site clearing.

16.3.2.3 Self-Assessment



Written Assessment

1. Three of the following instruments are used in surveying, which one is old one out?
 - a) Dumpy level
 - b) Rod
 - c) Tractor
 - d) Measuring
2. Explain the term utility giving examples
3. Select the old one out
 - a) Tractor
 - b) Backhoe
 - c) Bulldoze
 - d) Theodolite

4. There are various methods of demolition of unwanted structures. Which one of the following is among them?
 - a) House demolition method
 - b) Down to tot demolition method
 - c) Explosive demolition method
 - d) Manual demolition method
5. Among the following, which material is used for holding?
 - a) Paper
 - b) Wool
 - c) Glass
 - d) Wood
6. Define the term utilities
7. Explain the word surveying and give three instruments used in surveying
8. You have qualified to be the site engineer in a construction of a health care facility in your county. Give the main steps that you will use in preparing a site preliminary report.

Oral Assessment

Outline the various site clearing tools

Project Assessment

You are entitled to be in charge of a government project in your area, prepare a site layout plan for the project.

16.3.2.4 Tools, Equipment, Supplies and Materials

Tools and equipment

- measuring and drawing tools
- computers/internet
- printers/plotting device
- calculator

Materials and supplies

- Codes of practice
- mechanical conventions,
- site office
- standard manuals and guidelines

Personal protective equipment (PPEs)

- dust coat
- First aid kits

16.3.2.5 References




Paul, R., & Whyte, W. (2012). *Basic surveying*. Routledge.

Rathi, S. O., & Khandve, P. V. (2014). Demolition of Buildings–An Overview. *International Journal of Advance Engineering and Research Development*, 1(6).

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16.3.3 Learning Outcome No 2: Execute Building Temporary Works

16.3.3.1 Learning Activities

Learning Outcome No 2: Execute Building Temporary Works	
 Learning Activities	Special Instructions
2.1 Construct and dismantle trench timbering 2.2 Construct and dismantle building formwork/shuttering 2.3 Erect and dismantle building scaffold 2.4 Erect and dismantle building shores	<ul style="list-style-type: none"> Undertake the project of building temporary works as required by the standard construction procedures

16.3.3.2 Information Sheet No16/LO2: Execute Building Temporary Works



Introduction to learning outcome

This section involves execution of frameworks that will guide the actual substructure works. It involves the general skeleton of what is expected after building works are completed.

Definition of key terms

Formwork – This is a temporary or a permanent structure in which fresh concrete is poured to construct structural elements which achieve its shape. Formwork can be classified into; engineered formwork, timber formwork and insulated formwork.

Scaffold – this is a temporary platform that is erected before commencement of construction or repair of a structure to ensure safety of workers, provide support on heights and also provide material during construction.

Content/Procedures/Methods/Illustrations

2.1 Construct and dismantle trench timbering according to standard construction procedures

A trench timbering is a process of providing boards and struts when the trench is large or the subsoil is loose to offer temporal support on the sides of the trench.

Timbering process

The timbering is made by placing vertical polling boards opposite each other against the walls of the trench and holding them in position by use of one or two rows of struts.

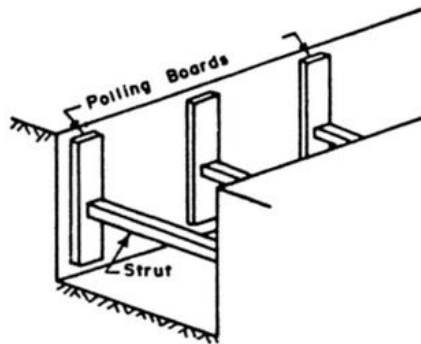


Figure 166: Timber vertical polling boards

Source: Building construction (punmia *et al*, 1987)

Dismantling process

Dismantling of a trench timbering is done under a supervision of a competent person to avoid the structure from collapsing. The trench timbering are dismantled step by step from below in a reverse order in which they were installed

Importance of trench timbering

- a) To support the trench when;
 - The soil is loose
 - The trench is large
- b) For the security of the workers

2.2 Construct and dismantle building formwork/shuttering according to standard construction procedures

A formwork is a process of creating temporary molds into which fresh concrete is poured and formed to make designated shapes. Formwork can be made of steel, wood or even fiber glass.

Steps in construction of formwork are as follow;

- i. Using measuring tools such as a measuring tape measure and indicate borders of concrete slabs
- ii. Guided by a string, frame the area
- iii. Lay gravel at the base of the formwork
- iv. Pour concrete inside the formwork

The formwork is dismantled only when the concrete has gained sufficient strength. Also, ensure stability of the remaining formwork during removal.

Steps followed in removing formwork are as follows;

- i. Ensure that the concrete had dried before removing the formwork
- ii. The forms are removed starting at the top of the sloping slabs
- iii. Remove the stakes by use of a stake puller to avoid damaging the slab
- iv. Use a little force to pull the forms away from the sides of the concrete

2.3 Erect and dismantle building scaffold according to standard construction procedures

Scaffold is a temporary platform that is erected before commencement of construction or repair of a structure to ensure safety of workers, provide support on heights and also provide material during construction

Recommended steps in making a scaffold

- i. Ensure that the foundation to the scaffold is secure to avoid settling of the scaffold
- ii. Assemble the scaffold frame and place the planks
- iii. Make an access to the scaffold
- iv. Attach guardrails to the scaffold
- v. Ensure that the scaffold is safe to work with

Dismantling of a scaffold is trained by a competent person.

Importance of scaffolds in building construction

- Ensure safety of workers
- Easy access of different parts of the building like the ceiling
- Provide a working area for workers

2.4 Erect and dismantle building shores according to standard construction procedures.

Shores are made to offer support to an infrastructure which is at a risk of collapsing. Shores maybe made angled, horizontal or vertical. Shores carry vertical loads from the walls.

Types of building shores and how they are made

Raking shores-made by joining one or more timbers connecting the ground and the surface of the structure to be supported

Hydraulic shoring- a hydraulic piston is pumped outwards until it presses against the face of the structure to be supported

Flying shoring- in this technique, horizontal strut is placed between the wall plates and is supported by a system of needle and cleats.

Dead shoring- The dead shore consists of an arrangement of beams and posts which are required to support the weight of the superstructure and transfer same to the substructure

Shores should be dismantled by a trained person. The shores are removed when the concrete has gained enough strength to support itself

Importance of shoring in construction

Safety- ensure safety of the work site by holding the earthen wall up

Lower cost-reduce the possibility of collapsed excavations

Save time- if trench collapsed, more time would be spend in digging it out again, therefore avoiding the collapse saves more time

Conclusion

This learning outcome covered the building of temporary works that form the basis of the actual building works of erection and dismantling of support systems in construction.

Further Reading



Read more on process of execution of superstructure works in a building

16.3.3.3 Self-Assessment



Written Assessment

1. Among the following, which one is the old one out?
 - a) Raking shores
 - b) Flying shores
 - c) Dead shores
 - d) Live shores
2. Formwork can be classified into various classes. Which one of the following is not?
 - a) Engineered formwork
 - b) Timber formwork
 - c) Insulated formwork.
 - d) Concrete formwork

3. Which among the following is not a step in construction of formwork?
 - a) Using measuring tools such as a measuring tape measure and indicate borders of concrete slabs
 - b) Guided by a string, frame the area
 - c) Lay gravel at the base of the formwork
 - d) Pour water on the gravel
4. Evaluate how formworks are made.
5. What is the difference between scaffold and shores?
6. Evaluate three types of shores
7. Illustrate steps of constructing a formwork

Oral Assessment

Describe the importance of scaffolding

Project Assessment

Design a trench timbering to support the trench in your area.

16.3.3.4 Tools, Equipment, Supplies and Materials

Tools and equipment

- Measuring and drawing tools
- Computers/internet
- Printers/plotting device
- Calculator

Materials and supplies

- Codes of practice
- Mechanical conventions,
- Site office
- Standard manuals and guidelines

Personal protective equipment (PPEs)

- Dust coat
- First aid kits

16.3.3.5 References




Chen, W. F., & Mosallam, K. H. (2000). Concrete buildings analysis for safe construction (Vol. 2). CRC Press.

Rupasinghe, R., & Nolan, E. (2007). Formwork for modern, efficient concrete construction. Publication of BRE. Garston, Watford. UK 978-1-86081-975-9

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16.3.4 Learning Outcome No 3: Execute Substructure Works

16.3.4.1 Learning Activities

Learning Outcome No 3: Execute Substructure Works	
 Learning Activities	Special Instructions
3.1 Excavate building foundation 3.2 Set out the building 3.3 Lay the building foundation 3.4 Erect foundation walls 3.5 Construct solid ground floor	<ul style="list-style-type: none"> • Conduct setting out procedure and provide the necessary tools and equipment • Perform soil analysis

16.3.4.2 Information Sheet No16/LO3: Execute Substructure Works



Introduction to learning outcome

This involves the building of structures below the earth surface on site as guided by the standard construction procedures. These structures include the foundation or footings.

Definition of key terms

Foundation: This is an engineered system that transfers to and into the beneath soil or rock the loads supported by the foundation and its self-weight

Setting Out: this is a term referring to marks and line formation in order to define the position of the elements and their levels for the building works so that works may proceed with reference to them.

Content/Procedures/Methods/Illustrations

3.1 Excavate building foundation according to standard construction procedure

Excavation: refers to the process of removing soil, rock and other non-decomposing materials with tools, equipment or explosives. Excavation is used in building works to create foundations for structures. Excavation of building foundation involves several activities. These activities include:

Clearing the site before excavation, setting out of foundation layout before excavation and carrying out an actual excavation

- How Excavation for foundation is carried out

Excavation is carried out manually using the available tools like the spades, pick axes etc. in small building works. In the case of big constructions and deep excavations, mechanical earth moving machines like excavators and back hoes can be used.

3.2 Set out the building according to standard construction procedures

Setting out of a building is done in order to clearly define the outline of the excavation and the Centre line of the walls so that the construction can be carried out exactly according to the plan. Building setting out methods include

- Pegging method
- Blocks method

Setting out using pegging: this is done after obtaining the architectural building plan and the site has been cleared.

STEPS (according to the contractor website)

- Initially, consider all the corners where the proposed columns or pillars will be situated and establish the corners relative to the dimension of the building floor plan and peg it.
- Hit nails at the middle – top of each peg and run a rope round all the pegs. Considering just one, measure the setback from back of the fence to the end of the building lines in that particular angle, then come to the front and measure the setback also as given in your drawing plan.
- Then use the back or the front as a reference depending on which setback is more important to you. Measure the setback from fence and establish these two points with pegs then put a rope to cross both pegs. Ensure they form a right angle or 90 degrees. To determine if your rope are at right angle, put a checker popularly called ‘square’ by bricklayers, this will tell you whether you need to shift the other rope that can be varied since one is already fixed to form a base mark.
- Next step is to ensure that your measurement correspond to the measurements on the drawing plan and then establish the other two points using the square.
- Nail pegs at an interval of 3m round below the rope that marks your building line, then join the tie rods by nailing (flat thin wood) on top around the entire area.
- Institute the individual rooms measurements by nails (4 nails are required at each measurement) two will establish the two sides of the blocks one is going to excavate, the length of this is usually three times the width of the block that is being used.
- In accordance with the details in the plan, mark with line the width to be excavated with pegs at appropriate positions. The excavation width is marked using lime or by furrow with spade.

- viii. The depth dug depends on the foundation type as recommended by your structural engineer.
- ix. Cast the concrete bed/base
- x. The next step is to determine where your blocks will follow by using the nails on your profile board. Set blocks 3-4 or more courses or partitions in reference to the topography of the site.
- xi. All the trenches on the surface should be filled and then backfilled.
- xii. Cast the solid floor slab for the ground or the oversite floor.

3.3 Lay the building foundation according to standard construction procedures

Steps for laying a foundation of a building

- i. Select the type of foundation to build. The choice will depend on the type of superstructure it will support and the type of soil among many others.
- ii. Set your footings 2 feet (0.61.) (60.96cm) crosswise. Add 2 feet on either side. This will ensure that the formwork is properly spaced and allows one to get the space they need for foundation laying.
- iii. Arrange your 2inch wide by 10-inch-long (5.08cm wide by 25.4cm long) boards to make the footings formwork. Position and lay down the boards in the planned foundation shape and size.
- iv. Straighten and level the form. The forms cannot be adjusted after the concrete is poured. Since the concrete is very weighty, make sure your formwork is strong and firmly in place.
- v. Form the concrete by adding all the mixtures in proper ratio and mix thoroughly to come up with a uniform mixture.
- vi. Pour the already made concrete in the form to make concrete foundation and then level using a trowel.
- vii. Finish your concrete by letting it dry and carry out curing



Figure 167: Concrete by letting it dry and carry out curing
Source: Design building.com – foundation construction building site.

3.4 Erect foundation walls according to standard construction procedures

Several materials exist for making the walls for foundation. These materials can be rocks, concrete blocks, sand – cement, or stabilized earth materials. The choice of all the above-mentioned materials will depend on the availability of these material, the client’s budget, and whether or not earthquakes or severe weather conditions will require reinforcement in the foundation.

How to erect foundation walls

- i. Lay the blinding and cast the foundation
- ii. Lay an impermeable material/layer on the predetermined positions
- iii. Allow the combination to cure
- iv. Cut the blocks and lay the subsequent course blocks
- v. Add the reinforcements
- vi. Finish the joints
- vii. Lay the cap blocks

3.5 Construct solid ground floor according to standard construction procedures

The formation method of a solid concrete slab involves the construction of formwork, placing and reinforcement of the floor.

Construction steps

- i. The first step is to combine and put up formwork.
- ii. The second step is to put in order and place the reinforcements as directed by the structural engineer.
- iii. The third step is to pour, compact and finish the concrete.
- iv. The final step is curing and removal of formwork.

Conclusion

This learning outcome covered the execution of foundation building and construction of ground floor as per standard construction procedures.

Further Reading



Read on the types of foundations, the block method of setting out and the circumstances under which all the foundation types are used.

16.3.4.3 Self-Assessment



Written Assessment

1. Which one of the following is not a shallow foundation?
 - a) Spread
 - b) Strap
 - c) Pile
 - d) Combine
2. The following are not substructure element in building works, which one is?
 - a) Foundation
 - b) Roof
 - c) Beams
 - d) Columns
3. which one of the following is a not a deep foundation
 - a) Pile
 - b) pier
 - c) strip
 - d) caissons

4. The following activities are carried out during the construction of substructures. Which one is not
 - a) Dewatering
 - b) excavation
 - c) setting out
 - d) Finishing
5. In what circumstances are shallow foundations preferred?
 - a) In case the client orders that a shallow foundation should be used
 - b) When the construction cost is high and using a shallow foundation will cut the cost
 - c) When the soil surface is hard and stable
 - d) When the contractor is only perfect in construction of a shallow foundation
6. under what circumstances do we use deep foundations
 - a) In case the structural engineer specifies so
 - b) When the soil is stable and hard
 - c) When the construction equipment is available
 - d) When the contractor prefers deep foundation over shallow foundation
7. Why should the surface be excavated before the foundation is laid?
 - a) To show that construction is yet to begin
 - b) To remove top humus soil that are not favorable for laying of foundation
 - c) To get soil used for construction
 - d) To increase the number of construction days in order to increase the labour cost
8. Classify and evaluate the four types of foundations
9. Evaluate three equipment and tools used in excavation process
10. Distinguish the methods used to set out the building
11. Differentiate between the shallow and deep foundation
12. Explain the methods used to control termite in the site during the construction of substructure

Essay questions

1. Summarize the different activities that are carried out during excavation process
2. Discuss some of the tools that are used in the construction of substructure of a building.
3. Distinguish the circumstances under which dewatering is recommended and evaluate its importance.

Oral Assessment

1. Distinguish the role of an engineer in the construction of a substructure?
2. Explain the factors considered during the construction of a substructure?
3. Evaluate the importance of dewatering during the excavation process?
4. Why is it necessary to compact the ground after excavation?

5. What are the requirements to be met before walling begins?
6. What are the failure signs in the substructure?
7. Evaluate causes failure of the substructure?

Case Study Assessment

The county government of Siaya is planning to set up a training institute at ganja town. The site has been identified and from the soil study analysis, the site is underlain by expansive clay soul to a depth of 20 cm deep resting on a hard rock surface. Adjacent to the site is a water logged plot. As a fresh graduate from the institution, you have been selected by the county engineer to assist in the construction and supervision of the substructure of the administration building. You are tasked with the excavation works, setting out and laying of the foundation. How will you ensure that these works are successfully executed?

- During curing of a pad foundations of a two bedroomed house, you notice that the levels of the reinforcement bars are not equal, as a trainee technician, what action you should take. What could have caused this scenario?

Project Assessment

Your school has decided to construct a new female house. It is a two storey building. Both the architectural and structural drawings are available and the contractor is ready to start the construction work. As a student, you are tasked to visit the site and carry out some studies. Afterwards, you are tasked with coming up with a detailed report of the stepwise activities that were carried out at the site until the substructure of the building was complete.

16.3.4.4 Tools, Equipment, Supplies and Materials

Tools and equipment

- Measuring and drawing tools
- Computers/internet
- Printers/plotting device
- Calculator

Materials and supplies

- Codes of practice
- Mechanical conventions,
- Site office
- Standard manuals and guidelines

Personal protective equipment (PPEs)

- Dust coat
- First aid kits

16.3.4.5 References




Cao, J., Wang, W., Wang, J., & Wang, R. (2016). Excavation equipment recognition based on novel acoustic statistical features. *IEEE transactions on cybernetics*, 47(12), 4392-4404.

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16.3.5 Learning Outcome No 4: Execute Superstructure Works

16.3.5.1 Learning Activities

Learning Outcome No 4: Execute Superstructure Works	
 Learning Activities	Special Instructions
4.1 Set out and construct superstructure columns 4.2 Set out and erect superstructure walling 4.3 Set out and construct superstructure beams, stairs and upper floors 4.4 Set out and erect building roof 4.5 Construct the fire place 4.6 Fixtures (electric sockets, light fixtures, plumbing installations, security and fire alarm systems) and fittings (furniture, hand driers, soap dispensers, towel hangers, cabinets) are installed	<ul style="list-style-type: none"> • Ensure the setting out procedure is based on the construction method used.

16.3.5.2 Information Sheet No16/LO4: Execute Superstructure Works



Introduction to learning outcome

This involves setting out, erecting and constructing the superstructure's columns, walls, beams, roof among other structures.

Definition of key terms

Fixtures: these are permanent equipment that are installed in a building to enhance client's satisfaction. They include the installation of sockets, water plumbing lines, alarm systems among many others

Fittings: are the temporary equipment that are brought in a building to enhance comfort. They include the furniture, electrical appliances, curtains etc.

Content/Procedures/Methods/Illustrations

4.1 Set out and construct superstructure columns based on the construction method

Columns are compressional members that support the loads from the beam or the slabs. In some cases they support moments as well. Columns are set out in accordance to the specification by the structural engineer. Before casting the columns, form work is first done. The forms will ensure that the lean concrete is held in place. The already mixed concrete is then dispensed and compacted in order to avoid void formation as the concrete dries.

Steps for constructing a column.

- i. Column layout work- the location is done essentially in the construction site by laying a rope as per the grid lines shown in the structural drawing plan
- ii. Reinforcement of column work - when column marking is done, then the column location is done. However the reinforcement is done according to structural drawing
- iii. Formwork for the column- it is used to grip the poured concrete in place
- iv. Pouring of concrete- can be done manually or using machine or pump

4.2 Set out and erect superstructure walling based on the construction method

Several materials exist for the construction of walls. These materials are; glasses, masonry blocks, bricks and stones. The choice of these materials depends on the client's preference, the design specifications and the availability of materials. The walls are constructed in accordance to the specifications of both the structural engineer and the architect. The mixtures must comply with the mix ratio design.

Steps for constructing masonry block wall

- i. After the foundation has cured, lay the first course block
- ii. Cut the blocks and lay the subsequent course blocks
- iii. Add the reinforcements
- iv. Finish the joints
- v. Lay the cap blocks



Figure 168: Constructing masonry block wall

Source: The contractor website – reinforced concrete masonry wall

4.3 Set out and construct superstructure beams, stairs and upper floors based on the construction method

Beams are structural members that carry the axial compression loads as well as the moments and torsion. They carry weight from the slabs and transfer them to the columns. They are set out in places pre identified by the structural engineer. They are constructed according to the structural engineer's specifications. The reinforcements are first laid followed by form work then pouring of the already prepared concrete then vibration of the same. Stairs are meant to carry the lateral loads like wind and earthquake. Upper floors transmits their dead loads and imposed loads (total loads) to the beams then to the columns and finally to the foundations.

Steps for setting out and constructing beams

- i. Preparation and excavation of the ground for the beam in case the beam is located below the ground surface.
- ii. Formwork installation for the beam
- iii. Beam reinforcement as per the structural engineer specification
- iv. Pouring of concrete into the formwork



Figure 169: Pouring of concrete into the formwork

Source: YouTube – tie beam fitted on foundation to construct a home

Steps for laying solid upper floors

- a) Assemble and Erect Formwork- this will provide a base for laying the reinforcements
- b) Prepare and Place Reinforcement- this should be done according to the specifications by a structural engineer
- c) Pour, Compact and Finish Concrete- this will ensure that the thickness of the solid slab is uniform
- d) Curing Concrete and Remove Formwork- curing increases the compressive strength of the concrete

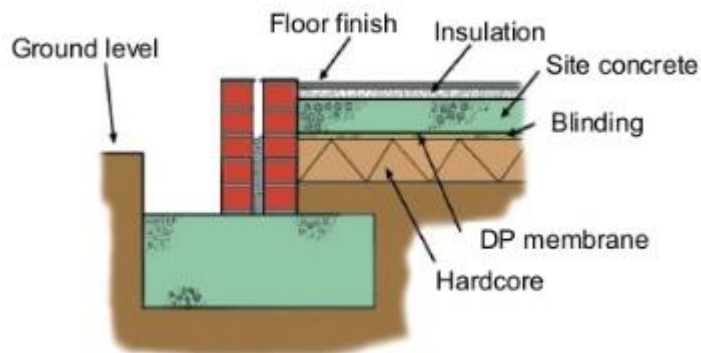


Figure 170: Curing Concrete

Source: slide share – section of solid ground floors

4.4 Set out and erect building roof according to standard construction procedures

Roof is the top most structure in a building. It can be made of tiles, iron sheets or concrete. The choice depends on the design, available materials and the client's preference. The roof is designed by the structural engineer and the dimensions given to the contractor. The type of the roof chosen depends on the design of the building

Steps for iron sheet roof construction

- i. Preparation of trusses according to the drawing
- ii. Preparation and joining of ties
- iii. Joining of trusses to the ties and other members according to the drawing specifications
- iv. Nailing of the iron sheets

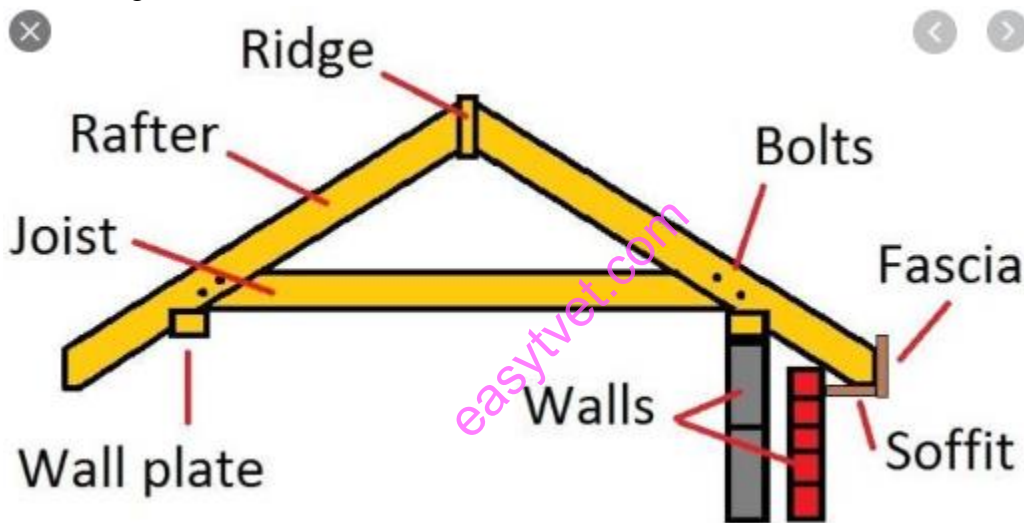


Figure 171: Erect building roof according to standard construction procedures

Source: Carpentry tips and tricks

4.5 Construct the fire place according to standard construction procedures

A fire place is specially designed and set aside for the purpose of heating the house and keeping it warm during cold seasons. It is constructed with high heat resistant concrete and it must be well ventilated.

Steps for constructing a concrete fire place

- i. Assemble and erect formwork- this will provide a base for laying the reinforcements
- ii. Prepare and place reinforcement- this should be done according to the specifications by a structural engineer
- iii. Pour, compact and finish concrete- this will ensure that the thickness of the solid slab is uniform

- iv. Curing concrete and remove formwork- curing increases the compressive strength of the concrete
- v. Construct the walling and provide for ventilation.

4.6 Fixtures which are the permanently installed equipment in a building are installed according to standard construction procedures.

Process of installing electricity on an already built house

- i. Assembling of the pipes and conduits
- ii. Aligning the positions that the conduits will follow
- iii. Mark the lines where the pipes will follow
- iv. Dig the marked line positions
- v. Insert the pipes and the wires as directed by the electrician
- vi. Hide the pipes by plastering them.

Conclusion

This learning outcome covered the setting out and construction of the superstructure works and installation of required fixtures and fittings as per the standard construction procedures.

Further Reading



Read further on the types of staircases, the types of fittings and on the factors controlling the design and construction of the superstructure.

16.3.5.3 Self-Assessment



Written Assessment

1. The following are superstructures except one. Which one is it?
 - a) Beams
 - b) Columns
 - c) walls
 - d) Footings
2. The following are compression members except one. Which one is it?
 - a) Masonry wall
 - b) column
 - c) Beam
 - d) Ties

3. What is the main function of form work in the construction of superstructure?
 - a) To add on the strength
 - b) To ease curing process
 - c) To hold the lean concrete
 - d) To make the work look more structural
4. Which of the following materials listed below is not suitable for the construction of a wall?
 - a) Concrete blocks
 - b) masonry blocks
 - c) bricks
 - d) synthesized cotton
5. Which one of the listed materials is not suitable for roof construction?
 - a) Corrugated iron sheets
 - b) tiles
 - c) concrete
 - d) plastics
6. Differentiate between fixtures and fittings
7. Explain the circumstances under which the column carry loads from the slab
8. Explain the conditions should be met during the construction of a fire place
9. Discuss the advantages of curing
10. Classify all the superstructure elements
11. Explain the term super structure

Essay questions

Discuss all the structural members in the super structure outlining their functions

Discuss all the factors that determines the choice of each of the materials used in all the super structures.

Oral Assessment

Differentiate between a sub structure and a super structure

Distinguish all the structural elements in each case.

Case Study Assessment

The Nairobi city council has decided to renovate their offices to make them look more modernized. The contractor whom you are working under has been tasked with the same. As his most trusted employee, he sends you to access the condition of the superstructure and list down all the fixtures and fittings that should be included. As a loyal employer, give a detailed report on the same to your employer

Practical Assessment

In your school vicinity, identify all the super structure structural elements and give their functions.

Project Assessment

Come up with a model showing all the substructure and superstructure elements. Indicate the materials they are made of and show how the loads are transferred.

16.3.5.4 Tools, Equipment, Supplies and Materials

Tools and equipment

- Measuring and drawing tools
- Computers/internet
- Printers/plotting device
- Calculator

Materials and supplies

- Codes Of Practice
- Mechanical Conventions,
- Site Office
- Standard Manuals And Guidelines

Personal protective equipment (PPEs)

- Dust coat
- First aid kits

16.3.5.5 References




Malley, J. O. (2007). AISC Seismic Design Manual: Moment Frames. In New Horizons and Better Practices (pp. 1-3)

David, F. (2007). Essentials of soil mechanics and foundations basic geotechnics. Pearson Education, Upper Saddle River.

Mosley, W. H., Hulse, R., & Bungey, J. H. (2012). Reinforced concrete design: to Eurocode 2. Macmillan International Higher Education.

16.3.6 Learning Outcome No.5: Execute Building Finishes

16.3.6.1 Learning Activities

Learning Outcome No 5: Execute building finishes	
 Learning Activities	Special Instructions
5.1 Apply Floor <i>finishes</i> 5.2 Paint building surfaces 5.3 Apply building facings 5.4 Apply <i>Wall finishes</i> (5.5 Apply <i>Ceiling finishes</i> (5.6 Carry out pointing and jointing 5.7 Perform building rough casting	<ul style="list-style-type: none">• Attach demonstration videos on how finishes are executed in building works.

16.3.6.2 Information Sheet No.16/LO5: Execute building finishes



Introduction to learning outcome

This unit focuses on building finishes that involves building surfaces and facings; floor, wall and ceiling finishes, as well as rough castings as per standard construction procedures.

Definition of key terms

Floor finishes-This is usually a permanent film applied to a floor in order to extend its life and act a protection. The covering also serves to provide an attractive appearance and friction preventing slipperiness.

Wall finishes-It's a film or a layer applied to the wall to enhance its look as it provides a decorative look either on the interior or exterior of a given structure.

Ceiling finishes- It's a layer to provide an embellishing skin to hide the components that have been used in building including structural members, wires, pipes, insulations and ductworks.

Content/Procedures/Methods/Illustrations

5.1 Apply Floor finishes (tiles, cement sand screed, terrazzo, wood parquets, and carpets) according to standard construction procedures.

Floor finishes are permanent films applied to a floor usually to extend its life and act as a protection. They also prevent slipperiness and appealing to the eye. Applying floor finishes in accordance to the standard construction procedure varies according to the type of floor finish. The following are the various standard procedures for applying the various floor finishes. Procedures;

i. Tiles

The type of tiles to be selected depends on the functional use and location. Substrate surface should be clean to ensure good bonding. Screed should be given ample time for curing by air according to the manufactures instructions. Provide level pegs before screeding then apply a slurry bond then the screed is laid immediately then levelled. Moisture content of the substrate is checked by the relative humidity method. The cement-sand render should also be allowed to air cure for at least 7 days.

INSTALLATION PROCESS OF CERAMIC TILES FLOORING

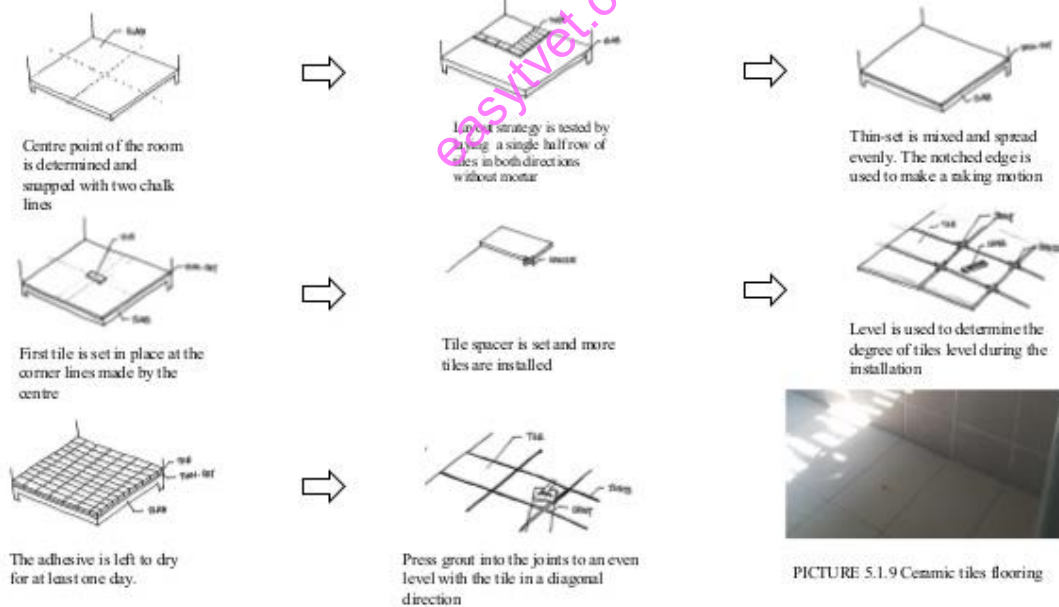


Figure 172: Installation process of ceramic tiles flooring

Source; <https://image.slidesharecdn.com/buildingconstructionii-report-160714013425/95/building-construction-ii-report-47-638.jpg?cb=1468460102>

ii. Cement Sand Screed

Check for the screed specification which should be according to the BS code of the practice requirements and ensure that the data sheets tally with the BS8000 and BS820. Inspect for the levels of base substrate for the attainment of the maximum or minimum screed thickness. Check for screed mix; required mixing proportion for normal cement and sand screed is 1:3 to 1:5. Check for batching and mixing requirements i.e. water and cement content and grading of the aggregate. Laying and compacting is followed by curing of screed, protection and testing.

i. Terrazzo

The materials should be thoroughly mixed for a uniform look (appearance). Uniform panels of not more than 2 sqm in neither area nor 2m long for the inner areas while for exposed areas it shouldn't be more than 1.25m long. 2kg of cement slurry should be applied for every sqm before the under layer is laid over the cement concrete. Strips of specific thickness can be used as required. It's then laid when the under layer is hard, this is in order to stop the cement that might travel to the top surface. The figures below show the procedure for laying terrazzo over the ground and over a structural slab;

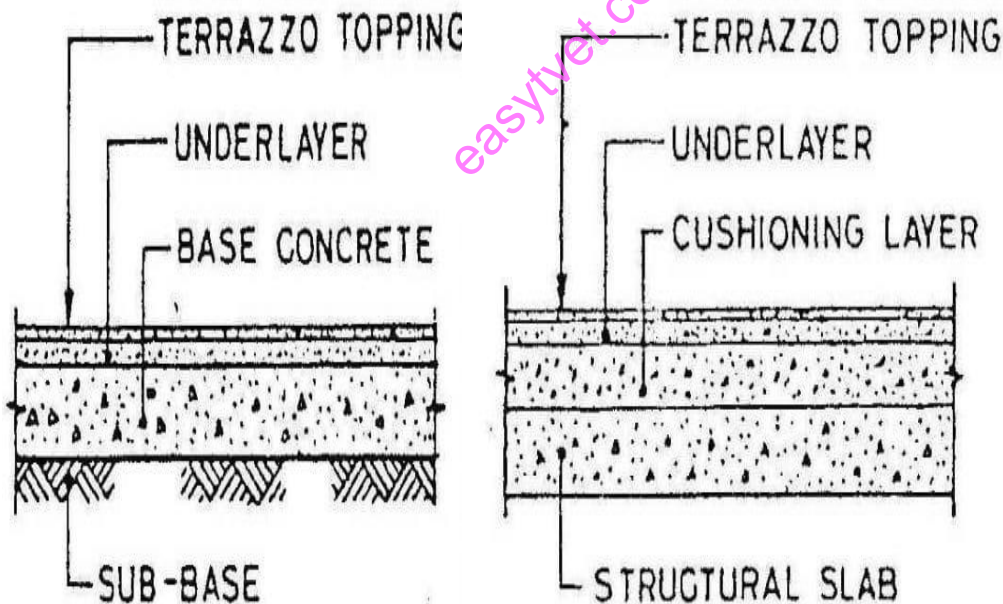


Figure 173: Installation process of terrazzo

Source;<https://theconstructor.org/wp-content/uploads/2010/10/Terrazzo-flooring-laid-over-the-structural-slab-557x380.jpg>

ii. Wood parquet

The first step is to carry out moisture content test of the underlying concrete slab. A film of 6-mil polyethylene is placed over the slab without mastic bonding. Then the plywood is then laid over the above film with the reinforcement of actuated nails made of concrete. Each panel takes about 9 nails of concrete. The arrangement of the panels is such that the end joints are staggered at 4 ft. The following illustrates the various patterns employed when installing wood parquet;

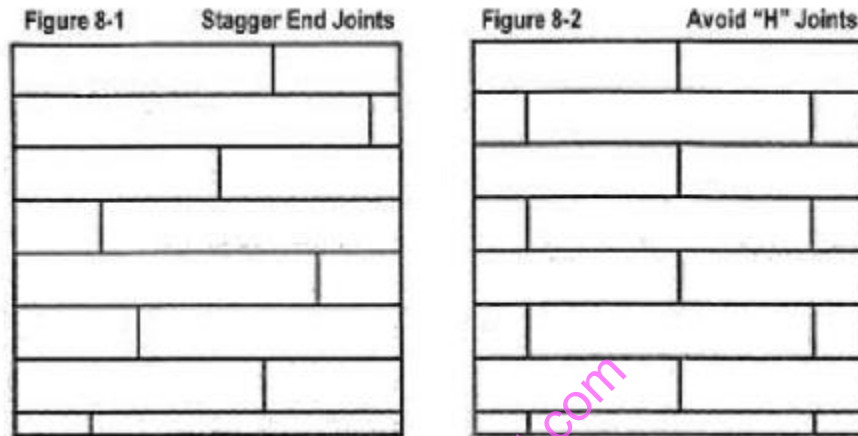


Figure 174: Wood parquet

Source; <https://www.oldwoodltd.com/uploads/nwfa-figure8-1-xl-1-w800.gif>

iii. Carpets

Broadloom Carpet entails various procedures as stated here; Carpet seaming that should be done according to the manufacturer's recommendations, trimming i.e. the seams, sealing the edges/seams, edge sealing. There's also the stretch-in installation that entails installing the carpet under tension using tack strips.

5.2 Paint building surfaces according to standard construction procedures.

Paint building of surfaces is done to bring colour, give a good texture and protect the surfaces. The painting of buildings should be in accordance with the British Standard codes that give for design considerations, selection of coating systems, special conditions and requirements, preparation and coating systems, surface preparations. Painting of plastered surfaces can be troublesome due to presence of moisture levels in the material of plaster.

Painting entails 5 steps;

1. Primer application
2. Wall putty application
3. Second putty application
4. The selected paint is the applied according to the type of surface
5. Then a repeat application of the paint

5.3 Apply building facings according to standard construction procedures

Building facings entails building a wall in a manner to be called a facing of any of two wall faces. The bricks used are usually hard enough to safely carry loads. The procedure for obtaining a facing is usually by joining bricks together except that other substitute materials can be used e.g. tiles. It's a range of bricks hard-burned to be able to support normal loads and be able to withstand adverse climatic conditions.

5.4 Apply Wall finishes (wall mastering, wall lining, and clad building walls) according to standard construction procedures

These finishes are for protection and aesthetic and can either be interior or exterior finishes. The procedures for good wall finishes require; that they are straight and plumb, smooth surfaces and the combustible free. Finishes are selected according to the functional use and availability. The following are the steps for carrying out the various types of finishes;

- i. Give time for brick to cure depending on type of construction material then allow the masonry brick to also cure
- ii. Get the mortar ratio i.e. of cement and sand
- iii. Next is to plaster the wall and give time to cure
- iv. Surface preparation by rubbing by a wall plaster
- v. Then the specific type of finish is applied

5.5 Apply Ceiling finishes (boards, T and G, gypsum board, acoustic ceilings) according to standard construction procedures

Ceiling finishes- It's a layer to provide an embellishing skin to hide the components that have been used in building including structural members, wires, pipes, insulations and ductworks. These are to be applied according to the manufacturer's instructions and detailing. The procedure for ceiling finishing involves the stated steps;

- i. The ceiling is first chipped
- ii. Its then washed by water which is then covered by cement grabbed
- iii. The grabbing cement is covered by a mortar and the specific type of ceiling applied

5.6 Carry out pointing and jointing according to standard construction procedures

Jointing is defining the mortar joints finish between bricks in order to bring a about a neat joint. Flush joints are mostly used for brickworks for uniform bricks with surfaces that are smooth. Pointing is an operation that entails filing a joint with a material that has been uniquely selected for authenticity or protection against adverse weather conditions.

The process of jointing involves;

- i. Cutting a cross joint
- ii. Filling the cross joints first, and then the pointing mortar pressed firmly to compaction

The process of pointing is rarely done on brick layers and it involves first clearing of loose debris and then the place wetted before pointing.

5.7 Perform building rough casting according to standard construction procedures

Rough casting refers to applying a spatter dash finish to a building. Small pebbles and gravel or other materials are usually mixed into the concrete to create a rough finish. The finish is applied in a thickness equal to that of the board by pressing out. The following is the procedure for rough casting manually;

- i. The wall is first cleaned and repaired if need be
- ii. The wall is then dampened in preparation for the first mix
- iii. Cement is chosen i.e. general cement or white cement
- iv. Selection of gravel or stone to be used and sand then mixed
- v. Water proofer and plasticiser is added to the mix then base coat applied
- vi. Base coat is scratched then the second and final coat is applied.
- vii. The sprayer is filled with the mixer then finally is clean up

Conclusion

This learning outcome covered the application of finishes such as floor, wall and ceiling finishes as per the construction procedures.

16.3.6.2 Further reading



Read more on:

1. Slide share on Wall finishes by Swapnika Reddy
2. Building Finishes, Fittings and Domestic Service by Chudley,R, R

16.3.6.3 Self-Assessment



Written Assessment

1. Which of the following is not a type of floor finish?
 - a) Tiles
 - b) Wood parquets
 - c) Terrazzo
 - d) Boards
2. Finishes fall in 2 categories except?
 - a) Self-finish and wet finish
 - b) Slippery finish and dry finish
3. The following are examples of wet finishes except?
 - a) Plaster
 - b) Paint
 - c) Wallpaper
 - d) Wood
4. The following are factors that affect the choice of floor finishes except?
 - a) Type of Base
 - b) Room usage
 - c) Cost
 - d) Colour
5. Floor finishes can be considered under the following 3 main heading. Which is not?
 - a) In situ
 - b) Applied
 - c) Timber
 - d) Gypsum
6. Explain the various methods of application of wood parquets?
7. Distinguish two types of floor finishes?
8. Differentiate between pointing and jointing?

Essay questions

Categorize various types of finishes

Describe the application of the terrazzo finish according to standard construction procedures.

Oral Assessment

What is a finish?

State the various types of finishes done on a building?

Case Study Assessment

A case study on the durability of terrazzo finishes over cement sand screed in buildings in Nairobi CBD

16.3.6.4 Tools, Equipment, Supplies and Materials

Tools and equipment

- Computers/internet
- Printers
- Calculator
- Measuring tools
- Trowels
- Rollers
- Jointer tool
- Polishers

Materials and supplies

- Codes of practice
- Site office
- Standard manuals
- Guidelines

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PPE (Personal protective equipment);

- Overalls
- Reflectors
- Helmet
- First Aid Kits

References




Wheeler, G.E. (2005) Alkoxysilane and the Consolidation of Stone. Getty Trust Publications, Santa Monica, CA.

EN 12004:2007 Adhesives for tiles – Definitions and specifications

BS 5385-5 (2011) Wall and floor tiling. Design and installation of terrazzo, natural stone and agglomeration stone tile and slab flooring. Code of practice

16.3.7 Learning Outcome No. 6: Execute Building External Works

16.3.7.1 Learning Activities

Learning Outcome No 6: Execute Building External Works	
 Learning Activities	Special Instructions
6.1 Lay external paving 6.2 Perform soft landscaping 6.3 Construct drainage system 6.4 Construct <i>fences</i> and gates	<ul style="list-style-type: none">• Carry out group discussions on various external works• Carry out a project on external works

16.3.7.2 Information Sheet No16/LO6: Execute Building External Works



Introduction to learning outcome

This involves learning the external works from design interpretation, measurements to the actual building.

Definition of Key terms

Fence: It's a structure that serves as a wall except that it doesn't have a solid foundation throughout its length. It encloses a given perimeter most of the cases outdoors and can either be a temporary or permanent structure.

Content/Procedures/Methods/Illustrations

6.1 Lay external paving based on the mode of construction

Laying of external paving basically entails laying pavements which is an outside floor that can be made of a variety of materials like concrete, asphalt, variety of stones and in some cases wood. Whether one is planning to install a brick, concrete or stone pavers, the following paver installation steps should help. The following are the steps that should be followed as briefly discussed;

a) Planning and layout

Decide whether your pavers will go and determine if there is enough space for them. Your plan can be drawn out and measured using graph paper.

b) Number of pavers required

The dimensions (length and width of the area) then calculate the area which is the square footage. Give an allowance of 5%

c) Excavation

Estimate the height the slabs should reach. After excavation temporary border is to be established.

d) Laying of the base material

This should be laid to a thickness that's tallies with the use planned for the pavers. The materials consists of crushed rocks of diverse sizes then compacted.

e) Jointing by sand

Basically involves sweeping sand over the pavers so as to fill the in between joints.

f) Sealing

The area after paving is first cleaned then sealed with a sand binding sealant preventing the sand from disappearing. Sealing also prevents stains and allows for easy cleaning.

g) The final step is maintenance that includes re-sealing, sweeping, regular cleaning.

The following figure demonstrates how to lay external pavers;

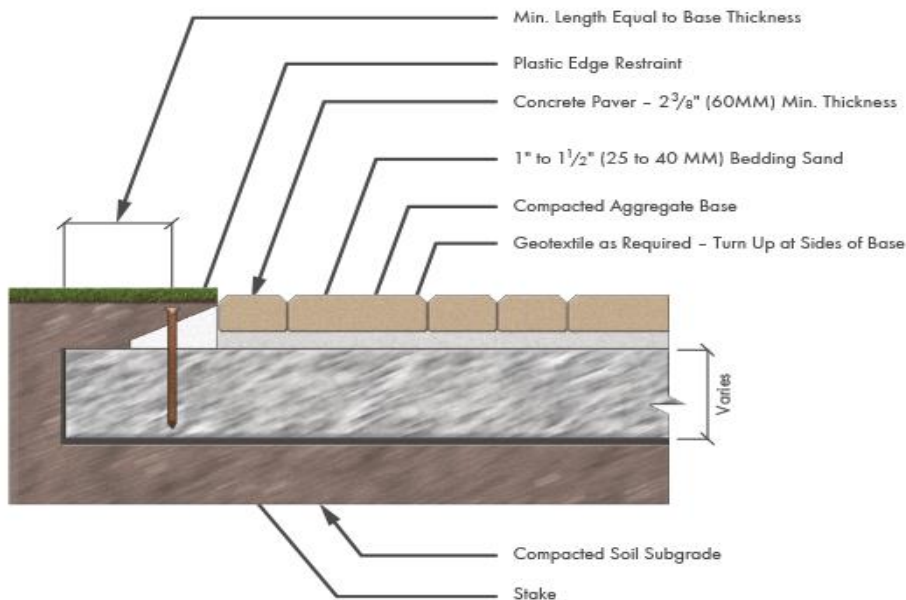


Figure 175: how to lay external pavers

Source; <http://www.claytonco.com/assets/images/gsp/installation/installation-guide.gif>

6.2 Perform soft landscaping based on the mode of construction

Soft landscaping involves operations on elements of landscape which are not construction related. Soft landscaping could involve working on trees, grasses, shrubs. Performing soft landscaping includes the following elements;

- a) Top soiling preparation; Subsoil should be properly compacted and thoroughly broken down.
- b) After soil preparation is cultivation to a depth of at least 100mm, weeding and cleaning of the area is also done at this stage.
- c) Turf should be specifically provided by the contractor as proposed and should comply with the BS 3969
- d) Planting whereby all the plants should comply with BS 3936 specifications
- e) Mulching is done to provide a hedge around the planted grasses or trees
- f) Protection of the grasses and trees at the hedges
- g) Trimming of the grass at intervals as it grows and maintained at certain prescribed level.

6.3 Construct drainage system based on the mode of construction

A drainage system is the artificial or natural removal of water either from surface or sub surface of an area that has excess water. Construction of a drainage system based on the mode of construction involves the following steps;

- i. Along the outside of the footing, a trench is dug that is at least 2 ft. wide. Depth can vary up to 6ft or as shallow as 2 ft.
- ii. The pipe is the laid on the undisturbed soil i.e. with the grade sloping away from the house to allow for the water to flow away by gravity
- iii. The pipe should then be covered by washed gravel (at least 12 inches)
- iv. A filter is then laid over to prevent clogging of the pipe
- v. The top soil is back- filled to its original grade height.

Below is a schematic of a drainage system;

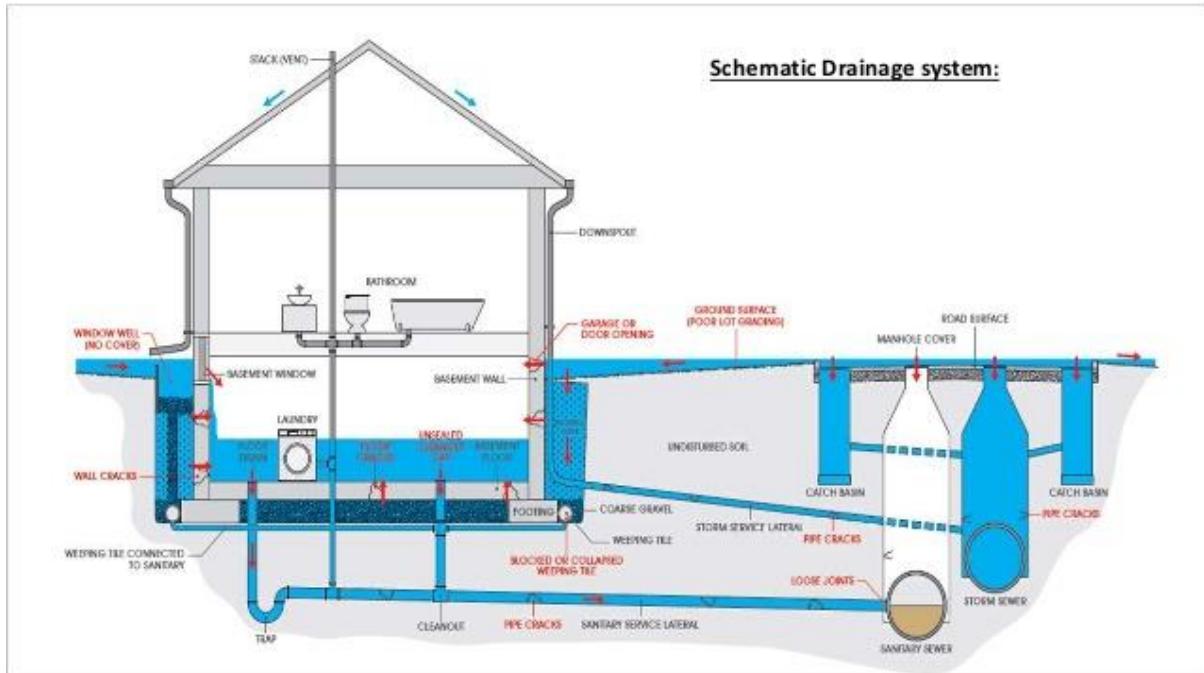


Figure 176: Schematic of a drainage system

Source; <https://image.slidesharecdn.com/myppt-160811185915/95/drainage-system-for-a-building-9-638.jpg?cb=1471597169>

6.4 Construct fences (masonry walls, live fence, reinforced concrete walling, wooden post and chain link/barbed wire, steel post and chain link, concrete post and chain link) and gates based on the mode of construction

A fence is a structure that serves as wall except that it doesn't have a solid foundation throughout its length. It encloses a given perimeter most of the cases outdoors and can either be a temporary or permanent structure.

Gate –is an entrance to a space that is fenced.

Construction of fences despite the various types of materials used must be homogeneous in terms of colour and design. Fences should be constructed in a manner to portray the completed side the fence to the lot adjoining or of any abutting. In residential areas the fence shouldn't exceed 3 ft. height unless for open mesh screening cases. The following are guidelines of constructing the above type of fences;

- a) The Construction Specification 92 should be applied
- b) The material specifications 591 that's compatible to Specification 92
- c) The items to be included in contract specifications and drawings includes; the plan, fence dimensions, details of the speciality materials, assemblies and posts details, the details of the gates is also included and the type/kind of fencing and the protective coatings and finishes if need be.

The construction of gates shall include the following steps;

- i. Erection at the place of manufacturing whereby it should first be assembled fully and inspected
- ii. Erection of the metalwork complying with BS 449 part 5 and comply with the recommendations of BS 5531
- iii. The gate is then tested after erection by the contractor to ensure it satisfies the clients' needs

Conclusion

This learning outcome covered external works such as paving, landscaping, drainage systems and fence and fence and gate construction.

Further Reading



Read more on;

1. Foundations, basement and external works by H W Harrison and P M Trot man
2. External works, Roads and Drainage by Phil Pitman

16.3.7.3 Self-Assessment



Written Assessment

1. The following are types of construction fences except one?
 - a) Masonry wall
 - b) Live fences
 - c) Moving fences
 - d) Chain link
2. Distinguish the various types of drainage systems.
3. Which of the following is not a step in the construction of a drainage system?
 - a) The outside of the footing, a trench is dug that is at least 2 ft. wide. Depth can vary up to 6ft or as shallow as 2 ft.
 - b) The pipe is the laid on the undisturbed soil i.e. with the grade sloping away from the house to allow for the water to flow away by gravity
 - c) The pipe should then be covered by washed gravel (at least 12 inches)
 - d) A concrete slab is laid over the pipe

4. Laying of external paving basically entails laying pavements which is an outside floor that can be made of a variety of the following materials except?

- a) Concrete
- b) Asphalt
- c) Stones
- d) Marble

5. The following are elements of soft landscaping except?

- a) Top soiling preparation; Subsoil should be properly compacted and thoroughly broken down.
- b) After soil preparation is cultivation to a depth of at least 100mm, weeding and cleaning of the area is also done at this stage.
- c) Turf should be specifically provided by the contractor as proposed and should comply with the BS 3969
- d) Planting whereby all the plants should comply with BS 5531 specifications

Short answer questions

Briefly explain the parts of a drainage system?

Differentiate between a wall and a fence?

Essay questions

Explain the steps of laying an external paving based on the mode of construction

Describe 5 elements of soft landscaping

Oral Assessment

How can one identify a soft landscape?

What is the difference between surface and subsurface drainage system?

Practical Assessment

Conduct a visit to KICC and document all elements of external building works employed in its design

Tools, equipment, supplies and Materials

- Survey tools
- Landscaping tools
- Design and rendering software
- Measuring and drawing tools
- Computers/internet
- Calculator

Personal protective equipment (PPEs)

- Overall
- Dustcoat
- Helmet
- Workshop Boots
- First Aid Kits

16.3.7.5 References



Xiu Hwei (2012). Water Drainage Engineering. China Architecture and Building Press
Yan Xushi, Liu Suiqing (2014). Water Supply and Drainage Engineering. China Architecture and Building Press

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