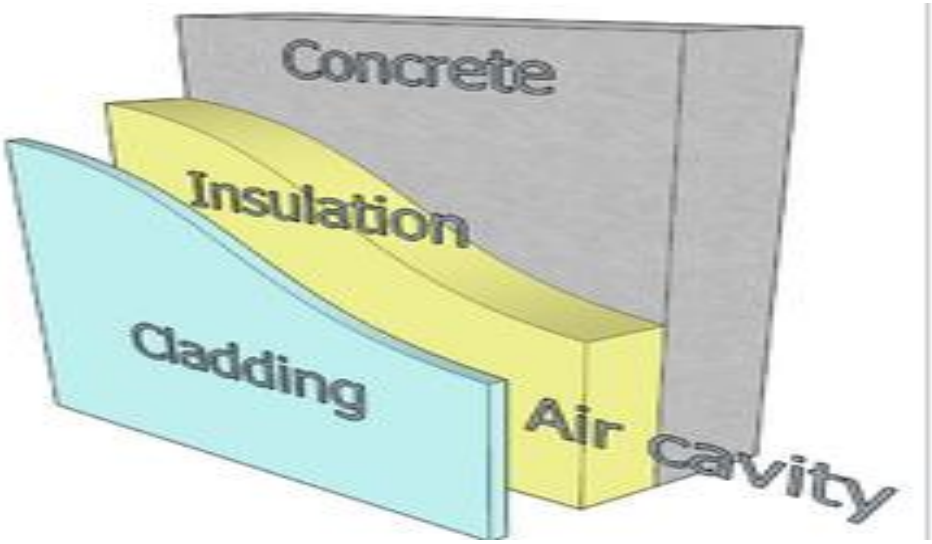
Finishing Construction Works

Level- v

Based on December 2024, Curriculum Version II

Module Title: - External wall cladding



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Prepared by: Ministry of Labor and Skill

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Acknowledgement

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We would like also to express our appreciation to the regional labor and skill bureaus, TVT colleges for their cooperation and technical support of this training module development.

Acronym

OHS	Occupational Health Standard
PPE	= Personal Safety Equipment
MSDS	= Material Safety Data Sheet
TTLM	= Teaching, Training and Learning Materials
uPVC	= un plasticized polyvinyl chloride
UV	= Ultraviolet
HVAC	= heating, ventilation and air conditioning

Introduction to the Module

External wall cladding helps to know how to Plan and prepare, preparation of production external wall finishing cast cladding cement center/work shop, Produce external wall finished cast cladding cement , Curing of external wall finished cast cladding cement , Smooth, rough and test the surface of external wall cast cladding cement , Installing and erecting of external wall cast cladding cement , Finishing of external wall cast cladding cement , Clean up and store equipment in finishing construction field. This module covers skill, knowledge and attitude required to Install and produce external wall finished cast cladding cement.

This module is designed to meet the industry requirement under the Finishing construction work occupational standard, particularly for the unit of competency**: Install and produce external wall finished cast cladding cement**

This module covers the Units:

- Introduction External Wall Cladding
- Safety and Environmental Considerations
- Material Preparation and Proportioning
- Application of external wall Cladding
- Decorative Finishes and Final Touches

Module Instruction

For effective use these 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: Introduction External Wall Cladding

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

- Concept of external wall cladding
- Tools, equipment, and materials overview.
- quality compliance external wall cladding

This unit will also assist you to attain the learning outcomes stated in the cover page.

Specifically, upon completion of this Training Module, you will be able to:

- Concept of external wall cladding
- Select Tools, equipment, and materials overview
- Analyse quality compliance of external wall cladding

1.1. Concept of external wall cladding

Cladding is a layer of skin that is attached to the exterior of a building to protect it from weather, water, and other elements. It can also provide thermal insulation, sound insulation, and fire resistance. Cladding can be made from a variety of materials, including concrete, wood, metal, brick, vinyl, and composite materials. ,so that Cast cladding cement is a type of concrete that is pre-formed into panels or tiles for use as cladding on a building's interior or exterior. Concrete cladding is a popular choice for its durability, aesthetic value, and other benefits.

The term CLADDING is used when thin concrete, stone, granite, marble or slate is employed as a facing in addition to the normal structural requirements. It should not be fixed too tightly to the structure, for some measure of give must be allowed so that the cladding does not bear the strain of the finished construction.

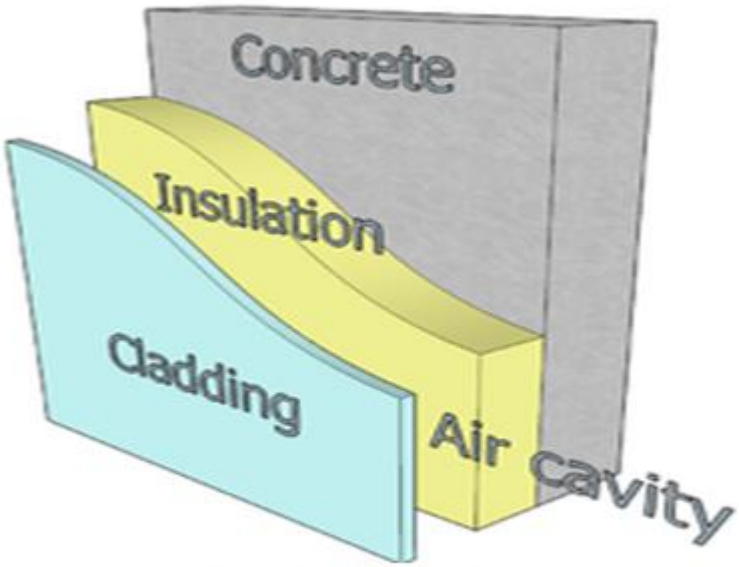


Fig 1.1 Wall Cladding

Purpose of External wall cladding

The purpose of external wall cladding is to protect the exterior of a building from the elements and other environmental factors. It also improves the building's aesthetic appeal and can provide thermal insulation and noise control.

Fig 1.1.1 protected external wall cladding

✓ **Some function of external wall Cladding must included but not limited**

- Be self supporting between the framing member
- Provide the necessary resistance to rain penetration.
- Be capable of resisting both positive and negative wind pressures.
- Provide the necessary resistance to wind penetration
- Give the required degree of thermal insulation
- Provide the required degree of sound, insulation to suit the building type.
- Give the required degree of fire resistance
- Provide sufficient openings for the admittance of natural daylight and ventilation
- Be constructed to a suitable size

Type of external wall cladding

- **Stone cladding**

Stone offers an elegant and rustic look to the space. Cladding works cover non-porous, moisture-resistant, and water-resistant properties in the best cladding types. Because stone is naturally derived, it avoids fading luster and high maintenance.

It gives the impression that the entire building is made from stone. Apart from cladding in buildings, stone cladding type is a great option for other outdoor areas like garden entrances. Stone may seem non-experimental at first glance, but many contemporary designs pile it up in slices, cut thin pieces, or make an attractive sheet. It enhances the textured appearance of a building.

Fig 1. 2 Stone cladding

- ✓ **Weather board cladding**

Weatherboard cladding material is also known as “featheredge.” Both refer to the external cladding slabs made from timber. Weatherboard is a great substitution for timber and uPVC. It is resistant to weathering, insect infestations and rotting and requires minimal maintenance. Not only is this cladding material an economical option for your building, but it also minimizes energyusege

since the weatherboard cladding type fights off moisture and intensive shock, it lasts for a long time. If you want to give your building a final touch of luxury, choose a fine exterior from the various textures and designs it offers. It is best to involve a professional in its installation. They are experts in placing the boards

Fig1.2. Weather board cladding

- **Wooden/Timber cladding**

Wooden cladding material will emerge as one of the best options. It is recyclable, and because it is usually made from exclusive wood types like cedar or hardwoods, pesticides don't feed on it either. Its application is popular in both indoor and outdoor cladding materials. Residents, as well as commercial property owners, deem it an excellent choice. Wooden cladding for buildings strikes insulation and energy efficiency in one power move. It also gives you the opportunity to improve the aesthetics of your space. Choose from a wide range of different timbers and textures. It is a one-stop solution to upscale the building's appearance and maintenance

Fig: 1.2 wooden/timber cladding

- **Tiles cladding**

Tiles are a fairly recent breakthrough in the realm of cladding materials for exterior walls. Suitable for both interior and exterior applications, tile cladding material for exterior walls withstands varying temperatures and winds and is a durable choice. Maintaining these tiles is a piece of cake for the next decade, and you can trust them to carry your building into the next decade.

Tile cladding for buildings gives you a reserve of creative freedom. It comes in a diverse palette of designs and textures so you can manifest the sophisticated abode of your dreams. Try something new with a combination of different-sized tiles. Put them together and see the unique suave look unfold. Such light cladding material is simple and fast to install.

Fig 1.2 Tiles cladding

- **External foam cladding**

True to its name, this type of cladding is made from foam called polystyrene. It protects your building from the most unpredictable weather conditions and drives termites away. It is complete with a touch core to protect the seemingly delicate fiberglass. Against the strong impacts of rain, snow, and winds, this outdoor wall cladding.

External foam cladding on buildings is available in a selection of different panels. It offers your building a crisp and elegant look. Before the panels are hoisted, bend the designs to your artistic preference. Owing to the foam's flexibility, the installation process is smooth.

Fig: 1.2 External foam cladding

- ✓ **Glass cladding**

Glass-cladding buildings in business hubs are the epitome of this cladding material. Because of its simplicity, it will fit right into your budget frames. Glass is easily tempered, curved, enameled, and laminated, so there is a huge scope for personalizing it to your taste. As for its visual appeal, it will woo your potential buyers with a classy and versatile look.

The set-up of this type of cladding begins with the age-old approach of piling brick cladding tiles. Glass panels are then mounted with up stands, which ensure that they withstand strong gusts of wind. Glass outdoor wall cladding is resistant to UV rays, winds, and rain.

Fig 1.2 Glass cladding

- ✓ **Aluminum cladding**

An aluminum composite cladding system is the go-to choice for external cladding type in building construction. Although it is lightweight, it is extremely resistant and rigid. It is firm and holds in place well. ACP is a long-term investment and requires minimal maintenance, making it a fairly convenient pick. Rest assured, it will protect your building against UV rays and different weather conditions.

Fig1.2 Aluminum cladding

- ✓ **Brick cladding**

Brick cladding often referred to as brick slips are a material used to cover the exterior of a building. in its most basic form, it is a full size brick that has been cut down to give you a brick

slip of 14-20mm for which you would then use to clad either the internal or external elements of your home.

Brick cladding is often also used on commercial buildings such as high rise offices and restaurants because it gives them an attractive appearance that makes them stand out from their competitors whilst offering over benefits of using traditional brick (mainly the space saving) Brick cladding comes in many different shapes, sizes, colors and textures so you can find one that fits your style perfectly.

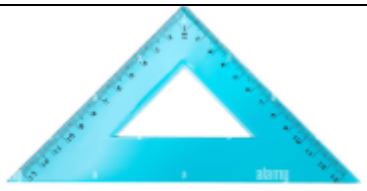
Fig: 1.2 Brick cladding

1.2. Tools, equipment, and materials overview

When constructing Install and produce external wall finished cast cladding cement, a variety of tools and equipment are required to ensure the job is completed efficiently and to a high standard. These tools are essential for tasks such as laying bricks or blocks, ensuring accurate measurements, and maintaining safety on the construction site. Here is a comprehensive list of the tools and equipment needed during the construction of Install and produce external wall finished cast cladding cement

Type of Tools and equipment for external cladding

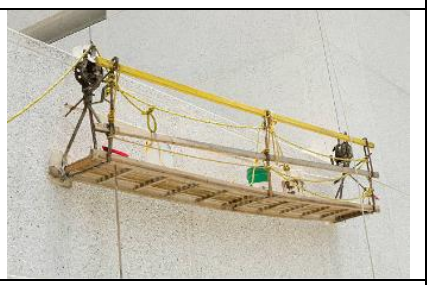
Table 1.1 tools and equipments

Name	Use of tools and equipments	Picture of tools and equipments
1. Hand tools		
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.	
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.	
Alignment string /masons' line/	Alignment string /mason line/, sometimes called, Fish line, is a rope used to transfer horizontal & vertical alignments or lines,	
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.	
Water level	The rubber water tube is filled with water until the level is half way up both glass tubes and them sealed when not tin use.	
Set Square	Square- For marking right angles.	

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.	
Measuring tape	Tape is used to measure dimensions of building parts and distances in site. It is manufactured from steel, plastic or fiber in lengths of 1m, 2m, 3m, 5m, 30m, etc. and 50m. In using tapes for measurements	
Block laying trowel	This is a tool, which every mason needs. Used for picking up mortar out of the barrel, spreading mortar on the wall	
Chisel	Used to cut concrete blocks, bricks, plaster surface and to remove mortar or concrete projections etc.	
Mortar spade/Shovel	Mortar spade is used to stir the mortar paste, prepared in the barrel or drum and keeps the mix to right and uniform consistency.	
Float	Steel floats are used to spread mortar bedding materials of sand and cement. A wooden float is best to move the mortar to shape the concrete material and the steel float is useful for finishing to a smooth finish.	

Bow saw:	Carpenters usually use Bow saw in the construction site in order to cut like eucalyptus wood.	
Utility knife	For cutting materials.	
Pry Bar	- For removing boards or adjusting materials	
Screwdrivers	- For fastening screws.	
Bucket	A Bucket is used to serve small amount of water or material and to take the tools after work.	
Wheelbarrow	Wheelbarrow is used to dispose disposal materials from working place, to transport or serve materials and tools during construction activities in the site.	
2.Power tools		
Circular Saw	- For cutting through cladding materials.	

		
Drill/Driver	- For drilling holes and driving screws.	
Nail Gun	For fast and efficient nailing.	
Jigsaw	For making intricate cuts.	
Reciprocating Saw	For demolition or cutting through tougher materials	
Concrete/ Mortar Mixer	Concrete mixers are available in from of different capacities. Small mixers can produce 250Lit of mortar or concrete and the big ones produces more and more, up to 6000Lit.Widely used, small mixers up to a capacity of 1000Lit. Mixers are driven with	

	diesel, benzene engine or electrical power.	
3.Lifting Equipment		
Scaffolding	- For safe access to high areas. Scaffolds are temporary structures used in construction, engineering, and other industries to provide support and access during the building or maintenance of structures. They are typically made of metal tubes or poles, along with wooden planks or platforms, and are erected around the perimeter of a building or structure.	
Ladders	For reaching elevated surfaces.	
Forklift	For moving heavy materials	
Suspended scaffolding	For moving heavy materials	
4. Measuring and Layout Tools		
Laser Level	For precise leveling over long distances.	

Chalk Line	For marking straight lines over surfaces	
5. Cleaning Tools		
Broom	A broom is an essential piece of equipment. A tidy worksite involves keeping areas swept clean of mud, dirt and rubble. Ensure have broom to clean up your site after completion of all your work	

Types Materials for external wall cladding

Cladding can be made of any of a wide range of materials including wood, metal, brick, vinyl, and composite materials. Wall cladding materials come in various types, each offering unique aesthetics, durability, and insulation properties. Here are some popular options

a. Wood /Timber

Timber cladding is one of the most natural materials cladding can be made from. When applied to the outside of a home it can add rustic appeal. Although easy to install, timber cladding will need annual treatment and maintenance to keep it looking new. From a structural point of view, timber is very stable and is popular with conventional designs.

Timber cladding has proven to be one of the most popular cladding in recent years due to its versatility and natural properties. It is one of the most environmentally friendly and reusable exterior cladding systems available on the market. Timber cladding can be used either indoors or outdoors, creating a natural and warm aesthetic for a home.

Available in a variety of colors and styles, timber offers a range of options for both traditional and modern cladding designs. Wood cladding can be installed vertically, diagonally or horizontally depending on the style you are aiming for.

Fig 1.2 wood/Timber

b. Stone

Layers of natural stone make up this external house cladding type. Stone creates a rustic exterior, popular with houses located in more rural settings. The many variations of stone cladding also make it a popular choice on new builds that are looking for a different finish to neighboring properties. Stone cladding is a good option for a domestic property, providing a more traditional aesthetic for the exterior of a house.

Stone cladding is a great choice for buildings that are exposed to harsh weather throughout the year. The natural properties of stone reduce the risk of dampness and water leaks.Stone cladding can include several natural stone materials, such as marble, sandstone or slate. In recent years, more people have been choosing a lightweight alternative in the form of simulated stone veneers. These achieve a similar look that is more cost-effective to buy and easier to install onto solid walls. Stone comes in various sizes, textures and cuts and can be installed in uniform lengths or random patterns.

Fig 1.2 Stone

c. Brick

Brick cladding panels can transform a house, with choices available to suit any architectural style. You might choose brick if you are looking to replicate a popular pattern or to simply protect the outside of your home from damage or weathering.

Fig 1.2 Brick

Metal

Metal cladding materials can often be found on agricultural and commercial buildings. They offer an easy-to-clean metal surface that reflects the industry it represents. **CladcoRoofing** supplies **Metal Cladding Sheets** that create a modern alternative to traditional

materials such as timber. Sheets are available in a range of coatings and colors to suit your budget and project. Choose from scratch-resistant **PVC** plastisol, smooth polyester paint, or plain galvanized steel sheets.

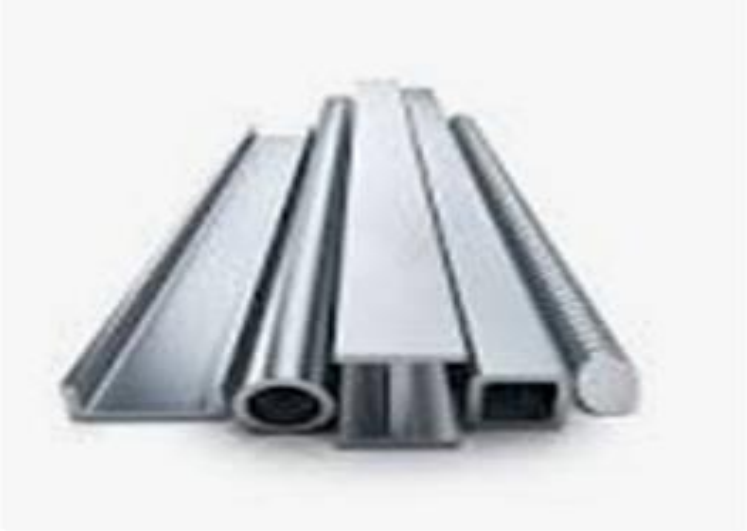


Fig 1.2 Metals

d. Tile

Tile is a popular choice for homes looking to stand out and increase curb appeal. Tile cladding provides insulation and protection from the elements. It can be manufactured from manmade or natural materials such as plastic or slate/clay. Tile cladding panels are commonly seen on internal applications but are also popular on external walls. Tiles can be customized to create different patterns or simply one uniform pattern across a building. A variety of colors and finishes makes this type of cladding very adaptable for creative applications.

Fig 1.2 Tiles

e. Glass

Glass is a modern aesthetic that allows plenty of natural light into the building. Glass cladding is a pricey option per square meter compared with other materials, however, they are low maintenance and long-lasting making them more of an investment in the long run. Glass cladding has proven to be a popular choice

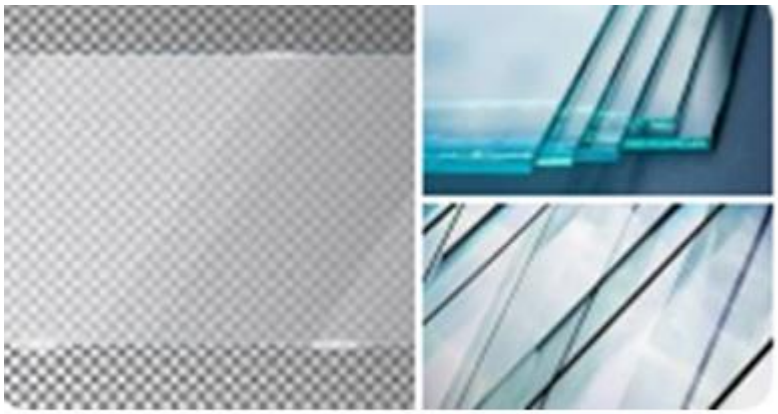


Fig 1.2 Tiles

1.3. Quality compliance external wall cladding

Quality compliance for external wall cladding involves ensuring that the cladding meets building regulations and is installed correctly.

- **Building regulations**

External walls should be designed to resist moisture, winds, fire, and thermal actions. They should also allow for proper ventilation

- **Cladding materials**

Cladding materials should be tested for use in the building and installed appropriately. For example, some materials are certified non-combustible

- **Insulation**

Insulation within the external wall system should not be combustible

- **Inspections**

An inspection can be carried out to verify that the system has been installed correctly and maintained in line with manufacturer guidelines and fire safety test data

Self-check (1)

Test-I Matching

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

Column " A"	Column " B"
---------1. Tile	A. featheredge
---------2. Circular saw	B. external house cladding type
---------3. Stone	C. Used For cutting through cladding material
_____4.Weatherboard cladding	
_____ 5. Cladding	D.. Suitable for both interior and exterior cladding applications
	E. layer of skin that is attached to the exterior /interior of a building to protect

Test II: **Short Answer writing**

Direction: Give short answer to the following questions. Time allotted for each item is 2minute and each question carry 4 point.

1. What is the advantage of wall cladding?
2. Mention Type of Cladding?
3. Mention at least 5 materials that used for cladding.
4. Write down at least five hand tools for external wall finished cast cladding cement

Note: Satisfactory rating – above 60% Unsatisfactory - below 60%

You can ask you teacher for the copy of the correct answers

Unit two: - Safety and Environmental Considerations

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

- Safety plans and OHS legislation.
- Handling and disposing of waste materials.
- Safe and sustainable practices in material usage

This unit will also assist you to attain the learning outcomes stated in the cover page.

Specifically, upon completion of this Training Module, you will be able to:

- Discuss Site safety plans and OHS legislation.
- Identify Handling and disposing of waste materials.
- Prepare Safe and sustainable practices in material usage.

2.1 Safety plans and OHS legislation

Safety in the workshops is subject to a number of various risk assessments and safe codes of working practices which have to be observed and adhered to by all workshop users and enforced by the person in charge of these areas.

Due to high risk activities taking place in the workshops access to these areas is restricted to authorized personnel only. No other person may enter the workshops without permission.

OHS requirements are followed in accordance with safety plans and policies. Plant, tools and equipment selected to carry out tasks are consistent with the requirements of the job, checked for serviceability and any faults are rectified or reported prior to commencement.

Safety requirements

Personal Protective Equipment (PPE)

Some of the commonly used PPE include the following:

Eye protection (goggles)

It is required to use eye protection equipments like goggle, eye shield, to protect our eye from dusts, chemicals, etc by all workers engaged in hazardous activities or are exposed to identify eye hazards.

Fig: 2.1.goggles

Hand Protection (leather glove)

It is required to use appropriate hand protection when hands are exposed to hazards, such as:

- Skin absorption from harmful substances;

- Cuts, lacerations or abrasions;
- Chemical exposure;
- Thermal burns and/or temperature extremes
- Potentially infectious material.

Fig: 2.1.1 Hand gloves

Body Protection

Chemical Resistant Clothing: Protective apparel designed to provide a barrier against a variety of chemical hazards. Chemical resistive clothing may be required for tasks where chemical splashing is anticipated or large volume transfers are conducted. Prior to selection of chemical resistant clothing, Laboratory Apparel and Scrub Suits:

A wide variety of styles and materials are available to protect employees during laboratory operations.

The selected type of lab coat or other apparel is designed to protect the wearer against accidental splashes or day-to-day handling of chemicals;

Safety Boots & Shoes: Super range of work safety boots & shoes from Redwood, Capps Composite & Panoply. Redwood is the premier brand for comfortable and reliable safety boots. Capps is the premium brand for sports-style safety boots

Over all

Fig: 2.1.1 (a) Over all

boots

Figs: 2.1.1(b) Boots

Ear and Hearing Protection

Ear plugs and muffs are available for any employee potentially exposed to noise levels

fig: 2.1.1(e) ear protetion

Head protector (Helmet**)**

Helmet: Safety hard hat are used to protect our head from accident during construction work.

Fig: 2.1. Helmet

Dust Mask: Mask reduces cost and optimizes comfort for mouse.

Gloves: Protective glove from Venire range includes cotton/polyester gloves, polyamide gloves and thermal polyester/acrylic gloves. With coated palm and fingers for exceptional grip. These protective gloves comply with the standard for hand protection.

Emergency procedures: Emergency plan is a written set of instructions that outlines what workers and others at the workplace should do in an emergency. An emergency plan must provide for the following: emergency procedures, including: an effective response to an emergency.

Extinguishing fires: Carbon Dioxide fire extinguishers extinguish fire by taking away the oxygen element of the fire triangle and also are removing the heat with a very cold discharge. Carbon dioxide can be used on Class B & C fires.

First aid Hazard control; Refers to workplace procedures adopted to minimize injury, reduce adverse health effects and control damage to plant or equipment. Hazard control practices are often standardized and taught to managers and safety personnel in a given industry. First aid is medical attention that is typically administered immediately after an injury or illness occurs. It usually consists of one-time, short-term treatment, such as cleaning minor cuts, treating minor burns, applying bandages

Fig: 2.1.First aid

- ✓ **Tools and equipment safety**

Protecting raw materials in masonry work is crucial to ensure the quality and durability of the finished structure. Raw materials such as bricks, stones, and cement need to be safeguarded from various environmental factors and mishandling to maintain their integrity. Here are some essential methods for protecting raw materials in masonry work:

Proper Storage: Raw materials should be stored in a designated area that provides protection from weather elements such as rain, snow, and excessive sunlight. For instance, bricks and stones should be stacked on pallets and covered with waterproof tarpaulins to shield them from moisture.

Covering and Sealing: Utilizing covers and seals for raw materials can prevent them from being contaminated by dirt, dust, or other debris. Cement bags should be tightly sealed to prevent moisture absorption, while bricks and stones should be covered with tarps or plastic sheets to keep them clean.

Handling Precautions: When transporting raw materials to the construction site, it's essential to handle them with care to avoid breakage or damage. Proper lifting equipment should be used for heavy items, and fragile materials should be handled gently to prevent chipping or cracking.

Quality Control: Regular inspections of raw materials are necessary to identify any signs of damage or deterioration. Any compromised materials should be separated and replaced to maintain the overall quality of the construction project.

✓ **Environmental protection**

Environmental Considerations: Environmental factors such as temperature and humidity can impact the condition of raw materials. It's important to store materials in a controlled environment when possible, especially sensitive items like adhesives or sealants.

By implementing these protective measures, contractors can ensure that the raw materials used in masonry work remain in optimal condition, ultimately contributing to the structural integrity and longevity of the building.

2.2. Calculate and measure materials for external wall cladding

Materials Require

Building materials have an important role to play in this modern age of technology. Although their most important use is in construction activities, no field of engineering is conceivable without their use. Also, the building materials industry is an important contributor in our national economy as its output governs both the rate and the quality of construction work.

- Cement
- Sand (fine aggregates: fine and thick sand)
- Crushed Stone (thick aggregates)
- Sand & Gravel (natural mix of aggregates)
- Water

✓ **Calculating Materials**

General formula for calculating material list of mortar

Cement Mortar

Assuming 25% Shrinkage and 5% wastage

Item	Types of Work	Material required to produce 1m3 mortar
1	Cement Mortar 1:3	Cement = 460kgs Sand = 0.99 m^3
2	Cement Mortar 1:4	Cement = 308kgs Sand = 1.05 m^3
3	Cement Mortar 1:5	Cement = 306kgs Sand = 1.10 m^3
4	Cement Mortar 1:6	Cement = 263kgs Sand = 1.13 m^3

2.3. Safe and sustain able practices in material usage

Sustainable buildings can be achieved by considering the environmental effects in each phase of the building life cycle. Although there are previous and ongoing studies which ascertain the relationships between the building design/operations and the environment, the interaction between the building construction process and the environment is still largely unknown. This research proposes a method to appraise the sustainability level of construction process of different cladding systems by analyzing their construction techniques. The basic factors which affect the construction process were defined as time, resource use, conditions of the construction site and construction wastes, which were taken into account as the sustainability criteria in this study. Different construction techniques were evaluated according to the proposed method and were compared in defining the sustainability level of each technique's construction process.

- ✓ **Sustainability of external wall Cladding Materials**

Sustainable external wall cladding materials involves evaluating their environmental impact, durability, and local availability. By prioritizing these factors, architects and builders can contribute to more sustainable construction practices.

Incorporating renewable resources and recyclable materials into external wall cladding not only supports sustainable building practices but also contributes to the overall life cycle sustainability of structures. By prioritizing these materials, architects and builders can create more environmentally friendly buildings while also promoting resource conservation

Reclaimed Wood

Waste Reduction Utilizing reclaimed wood prevents deforestation and reduces landfill waste.

Aesthetic Value: Reclaimed wood often has unique character and history, enhancing the visual appeal of buildings.

Low Energy Use: Processing reclaimed wood typically requires less energy compared to new wood.

Natural Stone

Durability: Natural stone is incredibly durable and can last for generations, reducing the need for replacements.

Local Sourcing: When sourced locally, the environmental impact of transportation is minimized.

Low Maintenance: Stone requires minimal upkeep, further conserving resources over time.

Recyclability

Metal

High Recyclability Metals like aluminum and steel can be recycled multiple times without losing quality.

Energy Savings: Recycling metals uses significantly less energy compared to extracting and processing virgin materials.

Versatility: Recycled metal can be used in a variety of applications, including cladding.

- ✓ **Glass**

Infinite Recyclability Glass can be recycled indefinitely, making it a sustainable choice for cladding.

Aesthetic Appeal: Glass cladding can be visually striking and can enhance natural light within buildings.

Energy Efficiency: Properly designed glass facades can improve energy efficiency by allowing natural light while minimizing heat loss.

Composites

Recyclable Options: Some composite materials are designed for recyclability, allowing them to be reprocessed at the end of their life cycle.

Durability and Performance: Composites often provide good insulation and resistance to weathering, enhancing their sustainability profile.

- ✓ **Thermal and Energy Benefits**

Incorporating energy-efficient external wall cladding not only reduces energy bills but also supports passive solar design principles. By thoughtfully selecting materials and designing building envelopes, architects and builders can create structures that are both cost-effective and environmentally friendly, promoting long-term sustainability.

Improved Insulation: Cladding materials with high insulation values (R-values) minimize heat transfer. This means that during winter, less heat escapes from the building, and in summer, less heat enters, leading to lower energy demands for heating and cooling.

Energy-Efficient Materials: Materials like insulated panels, fiber cement, and thermal mass materials can significantly enhance energy efficiency. These materials help maintain stable indoor temperatures, reducing reliance on HVAC systems.

Cost Savings Over time, the initial investment in energy-efficient cladding can lead to substantial cost savings on energy bills, often offsetting the upfront costs through reduced utility expenses.

Thermal Mass: Materials with high thermal mass (such as stone or concrete) can absorb heat during the day and release it slowly, helping to stabilize indoor temperatures and reduce heating and cooling needs.

Overhangs and Shading Device: Designing cladding with built-in overhangs or shading elements can prevent overheating in the summer while allowing sunlight to warm the building during winter months.

Self check (2)

Part I: - Multiple question
Instruction: Choose the right answer from the given alternative

1. Which of the following is NOT mentioned as a component of personal protective equipment (PPE)?

A) Eye protection

B) Hand protection

C) Respiratory protection

D) Body protection

2. What should be done before starting work in the workshop?

A) Take a break

B) Wear protective clothing and equipment

C) Ignore safety protocols

D) Use damaged tools

3. What is a key requirement for handling and storing materials?

A) Store materials directly on the ground

B) Keep the site clean and tidy

C) Avoid checking the condition of materials

- D) Allow unauthorized personnel access

4. Which material is highlighted as a sustainable cladding option due to its natural properties?

A) Aluminum

B) Fiber Cement

C) Terracotta

D) Brick

Unit 3: Application of external wall cladding

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

- Application techniques for external wall cladding
- Surface Preparation
- Mixing cement in designed proportions.
- Installation of external wall cladding

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

- Discuss Application techniques for external wall cladding
- Prepare Surface Preparation
- Mixing cement in designed proportions.
- Ensure Installation of external wall cladding

3.1. Application techniques for external wall cladding

Cladding is an essential element in modern construction, offering both functional and aesthetic benefits to buildings. As the outermost layer applied to a building's facade, it serves various purposes, including protection against the element, insulation and enhancing the visual appeal of structure.

- ✓ **Application techniques**

Each cladding installation technique has specific requirements and best practices that must be followed to ensure durability, performance, and aesthetic quality. By understanding these techniques, builders can achieve effective, long-lasting cladding systems that enhance the overall integrity and appearance of the building.

Panel Systems Common panelized cladding materials include fiber cement, metal, and composite panels

Fastening Use screws or clips designed for the material. Ensure fasteners are spaced appropriately to accommodate thermal expansion and contraction

Lap Systems Panels should overlap to create a shingle-like effect, which helps to direct water away from the building.

Traditional Nailing or Screwing Method

Cladding panels are attached directly to the building's frame using nails or screws.

Fasteners penetrate through the panels, anchoring into the structural frame.

This straightforward method is versatile and suitable for various cladding materials.

Mechanical Fixing Method

Materials Suited: Metal, glass, stone.

Cladding panels are mechanically fixed to the building's structure using brackets or support systems.

This method offers adjustability and is ideal for heavier cladding materials.

Mechanical fixing ensures secure attachment while allowing some flexibility in panel placement.

Adhesive Bonding

Materials Suited: Glass, high-pressure laminates, some metal composites.

Cladding panels are bonded directly to the building's substrate using specialized adhesives.

This method creates a seamless, visually appealing finish without visible fasteners.

Ensuring the substrate is properly prepared is essential for a strong bond.

Interlocking Panel Systems

Materials Suited: Metal, composite materials, fiber cement.

Cladding panels feature interlocking edges that connect with adjacent panels, forming a continuous surface.

This technique enhances the building's appearance by minimizing visible joints.

Interlocking systems often allow for quicker installation

3.2. Surface Preparation

Proper surface preparation is essential for the long-term performance and aesthetic appeal of external wall cladding. Here are the key steps to follow:

- ✓ **. Inspection of the Substrate**

Evaluate Structural Integrity: Check for any signs of damage, such as cracks, bulges, or moisture issues. Ensure the substrate can support the weight of the cladding material.

Compatibility: Confirm that the substrate material (e.g., concrete, Stone , wood) is suitable for the chosen cladding system.

- ✓ **Cleaning the Surface**

Remove Contaminants: Clean the surface thoroughly to eliminate dust, dirt, grease, and any loose materials. Use:

Leveling:

If the surface is uneven, consider using leveling compounds or installing furring strips to create a flat, even base for the cladding.

- ✓ **Moisture Barrier Installation**

Weather-Resistant Barrier: Install a moisture barrier (such as house wrap or a breathable membrane) to prevent water infiltration. This is crucial in areas with high precipitation.

Sealing Joints: Ensure all joints around windows, doors, and other penetrations are properly sealed to prevent moisture intrusion.

- ✓ **Framing and Support Structure**

Install Lath or Backer Board: Depending on the cladding type, you may need to install lath (metal or fiberglass) or a cement backer board to provide a stable surface.

Check for Level and Plumb: Ensure the framework or lath is level and plumb to create a solid foundation for the cladding.

- ✓ **Final Inspection before Cladding**

Surface Check: Conduct a final inspection to ensure all surfaces are clean, dry, and properly prepared.

Review Manufacturer Instructions: Familiarize yourself with the specific requirements and recommendations of the cladding manufacturer for surface preparation and installation

- ✓ **Finishing smooth and rough surface**

Finishing is the operation of creating a concrete surface of a desired texture, smoothness and durability. The finish can be strictly functional or decorative .Why finish concrete? Finishing makes concrete attractive and serviceable. The final texture and hardness depends on the concretes end use.

A. Smooth Surface Finishing

1. Techniques.

Toweling: After the initial set, use hand towels or power trowels to smooth the surface.

Perform multiple passes, allowing for slight setting between towelings's to achieve a polished finish, Polishing- Once cured, surfaces can be polished using grinding pads to achieve a high-gloss finis and Smoothing Agents: Consider using smoothing compounds or overlays for additional refinement.

- ➢ **Benefits of smooth finish**

Aesthetic Appeal: A smooth finish is visually appealing and provides a modern look.

Ease of Maintenance: Smooth surfaces are easier to clean and maintain.

Water Resistance: Reduces water absorption, enhancing durability and longevity.

B. Rough Surface Finishing

1**. Techniques**

Textured Formwork: - Use rough or textured materials for formwork to impart a natural texture to the surface, Booming/Brushing: - After casting, use a broom or brush to create texture while the surface is still workable and Stamping - Employ stamping techniques on the surface before it sets to create decorative patterns and textures.

Benefits of Rough Surface Finishing

Enhanced Adhesion: Rough textures improve the adhesion of paints and coatings.

Unique Aesthetic: Provides character and can mimic natural stone or other materials.

Slip Resistance: Rough surfaces can offer better traction, making them suitable for outdoor applications.

3.3. Mixing cement in designed proportions

Purchase the materials that need. Portland cement is a dry powder and can be purchased at most hardware stores and building supply stores. The water can come straight from spigot at home. When buying sand, make sure to buy sand with angular (rather than smooth) grains. Masonry sand is ideal, and can be purchased from most building supply stores. Additives are available at most home improvement centers and building supply stores. Make sure to read the directions on the package and purchase the appropriate amount for your job. If want to augment mix with lime, make sure to buy hydrated lime (also a dry powder). The ratio of sand to cement is about 3:1 by volume

Fig: 3.3. Raw materials

Mix the dry ingredients. Using a shovel, smaller bucket or scoop, put three parts sand and one part cement into a mixing tub or trough, wheelbarrow, cement mixer or a 5-gallon (19 L) bucket. Add any dry additives according to the directions on the package and stir the powdered mixture thoroughly

Fig: 3.3 **Mix the dry ingredients**

Add water to the dry ingredients. Once mixed the dry ingredients thoroughly, add water a little bit at a time. Add a small amount of water, then distribute the water by carefully mixing with a spade or other tool. Keep adding water until the mortar reaches the proper consistency. It should be smooth and spreadable, but should not drip or run off spade when lift it. If you add too much water, adjust by adding more cement and sand

Fig: 3.3Add water to the dry ingredients

Use the cement mortar. Apply the mortar within about two hours of mixing it. If wait longer than that, it will likely have cured too much to use, but the curing time can be extended by adding retarders and by keeping the mortar cool or cold. Once the mortar begins to set and harden, *do not* attempt to thin the mix by adding more water.

Fig: 3.3. Use the cement mortar

Clean the tools. Run clear water over the tool and rub with gloved hand until all the mortar is removed. If the mortar has set on the tools, beat the the tools to break off the dried mortar, then rinse while scrubbing.

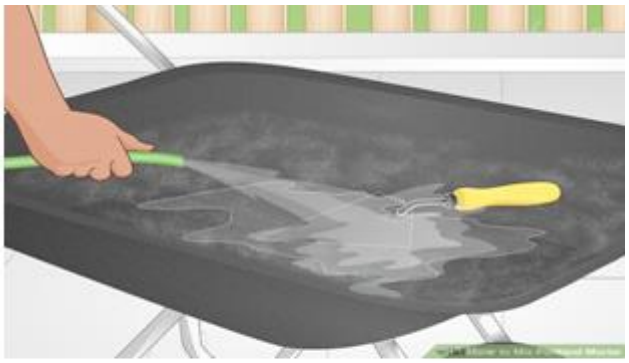


Fig: 3.3 clean the tools

3.4. Installation of external wall cladding

The process of installing external wall cladding typically involves the following steps:

- ✓ Prepare the wall

- ✓ Measure and cut the cladding
- ✓ Install the starter strip
- ✓ Set up the cladding panels
- ✓ Mount the end caps
- ✓ Check and add finishing touches

- ✓ **Installation of stone cladding**

Installing stone cladding on external walls enhances the aesthetic appeal and durability of a building. Stone masonry is the craft of shaping and laying stones to create structures and decorative elements. It has been practiced for thousands of years and has been used in the construction of various buildings, monuments, and sculptures throughout history. The process involves selecting appropriate stones, cutting and shaping them for external wall cladding

- ➢ **Types of Stone**
- ➢ Limestone

Limestone is a flexible material that is used for both interior and exterior walls of different buildings. Because it is so easily carved and sculpted, its unique and versatile pieces are ideal for cladding the paving, facades, stairs, and other structures of the buildings. For millennia, limestone has been a popular construction material because it combines limitless endurance with natural beauty and is relatively easy to cut or shape, resulting in some stunning architectural creations. Limestone cladding is praised for its uniformity and visual variation

Fig: 3.4 Limestones

✓ Mountain Ledge Stone

It is a rough layered rock with incredible patterns and designs. Any vertical surface is made more interesting by its deep shadows. It's made up largely of square-edged rocks with a variety of textures ranging from virtually smooth to abrasive. Like Northern Ledge, it is paneled rock which looks rustic yet contemporary in any architecture. It installs rapidly and has a slightly bigger average rock size, making it suitable for a wide range of applications.

Fig: 3.4 Mountain Ledge Stone

✓ Natural Stone

It creates the illusion that the wall is composed of genuine rocks. Quarrying various rocks and grinding them into tiny pieces produces natural rock. Wet cladding and dry cladding are both options for natural stone. It's also used in the interior of buildings. When properly positioned, the textures and cracks of these rocks provide a three-dimensional appearance, giving the impression that the building is entirely composed of rock.

Fig: 3.4. Natural stone

- **The properties of stones:**

The proprieties of stones which are important for stone masonry are strength and durability. Economy and appearance are additional requirements. The main considerations for durability are the lasting qualities of the stone itself and the locality where it is to be used. Porous stones are unsuitable for areas prone to heavy rainfall and frost. Stones, e.g. marbles having low porosity and low coefficients of expansion and contraction should be used in areas subjected to large variations in rainfall and temperatures.

Generally lime and cement mortars are used for stone masonry. Their function is to provide a workable matrix and ultimately a hard building material, which renders masonry into a monolithic unit.

- ✓ **Steps to install Stone cladding**

Clean the Wall Ensure the substrate is clean and free from dust, dirt, and loose materials.

Fig 3.4 Clean the wall

Dry Fit the Stones - Arrange stones on the ground to find the best pattern and minimize cuts-

Mark Starting Line Choose a starting point (usually at the bottom corner) and mark a level line across the wall for the first row of stones.

Mixing and Applying Adhesive Use thin-set mortar or a specific adhesive recommended for stone cladding

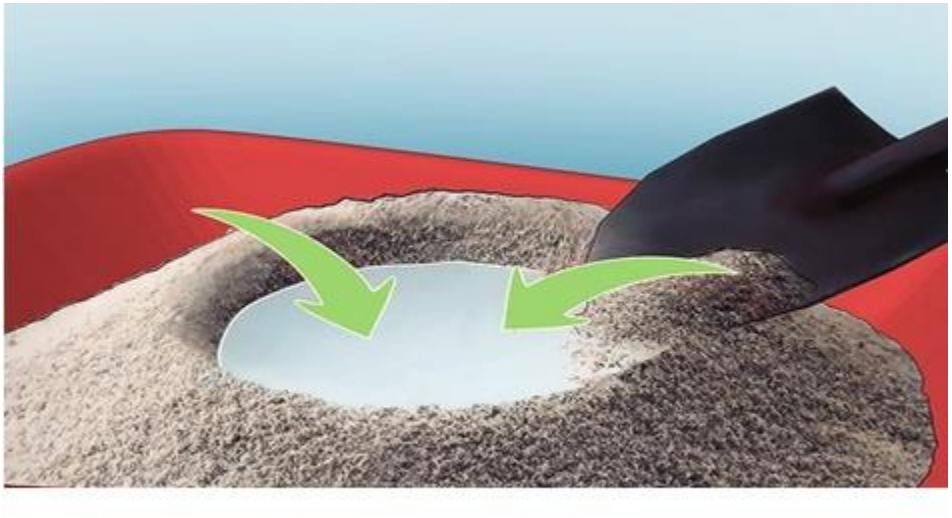


Fig:3.4 **Mixing and Applying**

Stone Placement- Position the Stones: Press each stone into the adhesive, twisting slightly for a secure bond. Start from the bottom and work upwards

Check Alignment Use a level to ensure each stone is aligned correctly. Adjust as necessary before the adhesive sets.

Maintain Gaps Leave consistent gaps between stones for grout or mortar, if applicable.

Cutting Stones Measure and Cut: Use a wet saw or angle grinder to cut stones as needed for edges, corners, and around openings.

Grouting (if applicable) Apply Grout- If using grout, apply it between the stones once the adhesive has set (usually after 24 hours).

Clean Excess Grout Wipe off excess grout from the stone surface with a damp sponge.

Sealing Seal the Stones, After the grout cures, apply a stone sealer to protect against moisture and staining. Follow the manufacturer's instructions for application.

Check for Alignment: Ensure all stones are securely attached and properly aligned.

Fig3.4 stone cladding

Clean Up: Remove debris and clean tools. Inspect the installation for any needed touch-ups.

- ✓ **Installation of brick cladding**

Brick cladding can be installed over brick exteriors. Brick provides a sturdy foundation for cladding, making it a durable and structurally stable option. Cladding can also enhance the design of your property and protect it from environmental factors

- ✓ **Installation of timber cladding**

External Wall – To clad an external wall, you need to attach battens to the wall and subsequently fix the cladding to these battens. Timber Frame Wall – To clad a timber frame wall, you need to attach the battens to studs in the wall. You can then subsequently fix the cladding to these battens

- ✓ **Steps for installing timber cladding on an external house wall:**

Prepare the wall: Ensure the wall surface is ready.

Attach battens: Attach battens to the wall, either to studs in a timber frame wall or with plugs and screws in a cavity wall.

Place nail stops: Place nail stops at the corners, windows, and limits of the cladding.

Install cladding: Fix the cladding to the battens.

Create a cavity: Create a cavity beneath the cladding to allow moisture to escape. The cavity should be at least 19 mm wide.

Add a waterproof membrane: Protect the building with a waterproof membrane.

Add a fly screen membrane: Prevent insects from getting in by adding a fly scree membrane if it's not sealed.

Leave gaps: Leave a minimum of 2 mm gaps around the boards for expansion.

Seal cut ends: Seal any cut ends, sides, or fixing holes.

Finish: Add finishing touches and check the work

- ✓ **Join element of external wall finishing**

Properly joining elements of cast cement cladding is crucial for the structural integrity and aesthetic quality of the finish. By following these notes, you can ensure that joints are secure, visually appealing, and resistant to environmental factors.

Joining Elements of External Wall Finishing with Cast Cement Cladding

- ✓ **Joining Technique**

Mechanical Fixings: Use mechanical fasteners (such as screws or anchors) to secure panels together, ensuring they are installed according to manufacturer specifications.

Adhesives: Consider using high-quality adhesives suitable for cement cladding to enhance joint strength.

Sealant Application: Apply sealant along the joints to prevent moisture ingress and provide a finished look.

Prior to installation: Composite wall cladding has been designed for beauty and ease of installation; it is not intended to be used as columns, support posts, beams or as other primary load-bearing members. Before installing it is advised to unpack the wall cladding boards for 48 hours to allow them to adapt to ambient temperature conditions. Always stack the boards on a flat surface. It is not recommended to install wall cladding boards in very cold temperatures. Installation of composite cladding

Installing the supports It is recommended that the battens used to support your wall cladding be made from composite material, this helps to maximize the long term performance of your

cladding. Alternatively, you can use wooden battens to support your cladding following the same fitting process as you would for composite battens. Battens should be 50mm wide x 30mm high and should be fully supported once installed, it is important that the surface below the battens is flat and stable in order to give the required support. composite wall cladding boards are more flexible than hardwood boards, it is important that you get your support structure right in order to prevent problems in the future.

Fig3.4 installing support

Battens should be attached to the surface at a maximum distance of 500mm apart. The battens will need to run the entire length of the area being clad, adding in additional battens at any point where you will need to join 2 cladding boards end to end. Remember to install your battens at a 90 degree angle to the way that you want your wall cladding boards to run. You will need to pre-drill the battens and the surface below using a 6mm drill bit, the battens are 30mm high and you will need to secure them at least 50mm into the surface below. You will need to choose fixings suitable for the surface you are fixing into. Screws should be 5-6mm diameter and at least 80mm long

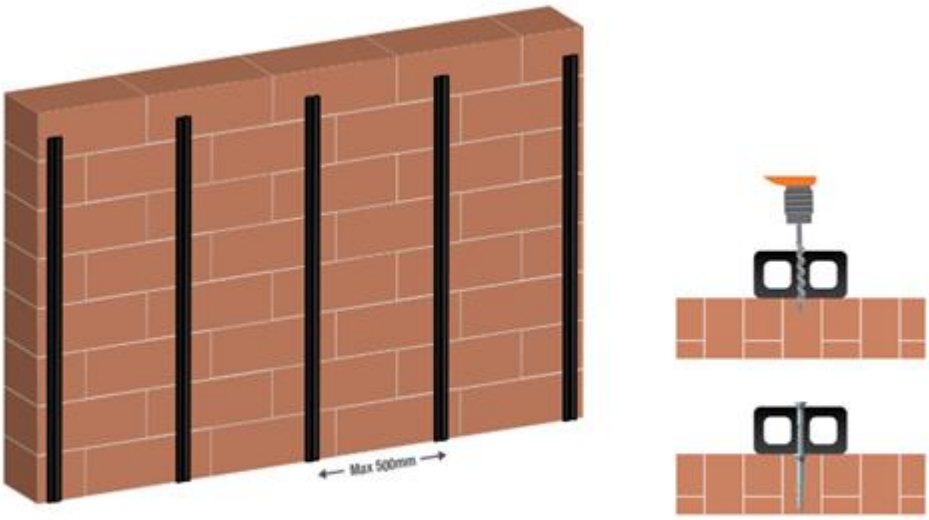


Fig3.4 installing support on wall cladding

Fitting the boards Attach a starter strip to the bottom of each joist, this will give the first cladding board something to sit on. You will need to pre-drill a pilot hole into the composite batten and attach the starter strip using a screw that is at least 15mm long. Ensure that each strip is level with the next and that the first board sits level on the clips before continuing to the next step. Place the first wall cladding board on to the starter strips. Mark and then pre-drill pilot holes through the fixing groove of the board into the composite batten below.

Fig3.4 fitting the board

Secure the boards using a screw at least 20mm in length, ensuring that the board is fastened securely on each joist that it touches. Secure these fixings by hand, is important not to over tighten the screws and risk splitting the board. Ensure that the section between the joists remains empty allowing air to flow beneath the boards. Slot the second board onto the first and repeat the fixing process ensuring that the second board is fitted securely in place on each joist. Repeat this process with each board until you reach the required height.

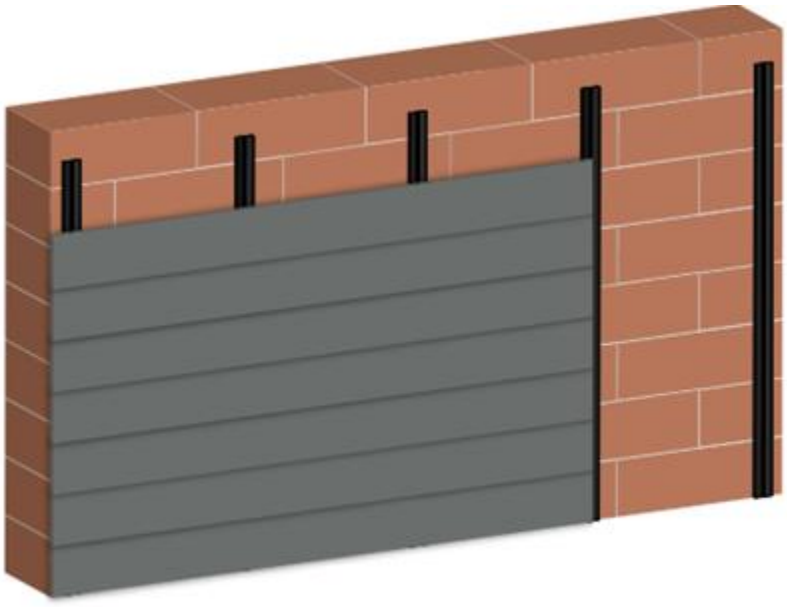


Fig3.4Secure the board

Continuing to fit the cladding :boards in this manner until you have completely covered the area you want. It is possible to fit your boards side by side in a brickwork pattern. You may need to install more battens if you wish to do this as each board will need to be supported on a joist where it meets the next board

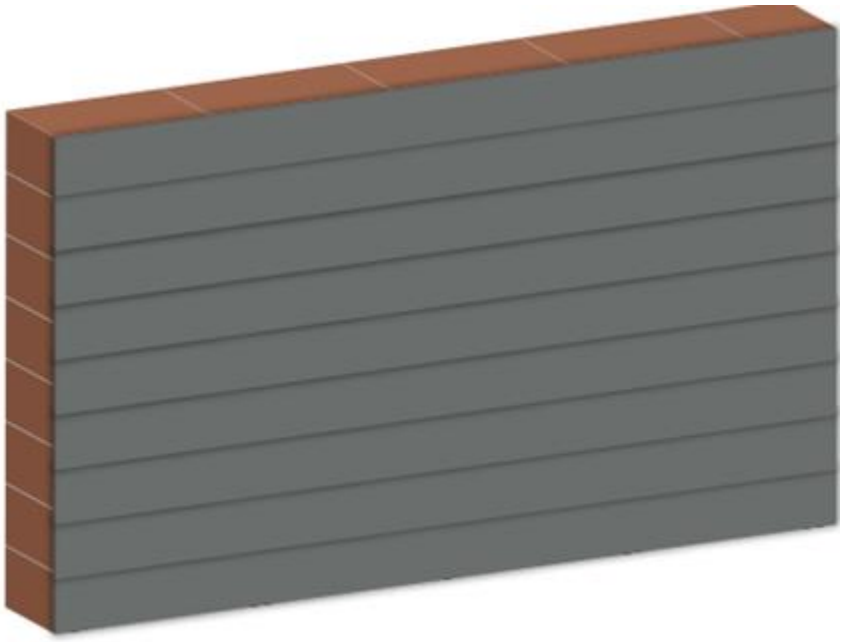


Fig3.4 continuing to fit the cladding

Finishing touches Depending on your installation, you may want to finish off the edges using one of the trims can provide to give you a lasting professional look. There are a range of trims available in all colors to compliment your cladding boards and these can be secured to your installation by screwing through the trim into the joist below every 300mm. Do not screw through wall cladding boards. Alternatively, if it is not possible to fix the trim to the joist without screwing through the wall cladding board you can glue them in place using an exterior grade high elastic glue. Do not completely seal your installation; allow some air to flow between the cladding boards and the surface below when fitting the trims.

Fig3.4 Fig3.4 Finish touch cladding installation

✓ **Joint Finishing**

Smooth Finish: Use tools to smooth out any excess adhesive or sealant for a clean look.

Texture Matching: If applicable, match the texture of the joint area to the surrounding panel surface.

Fig3.4 joint finishes

3.5. Curing water based on weather and standards

✓ Purpose of Curing

✓ **Methods of Curing**

Maintaining Moisture Concrete should be protected from losing moisture until final finishing by fogging or evaporation retarders. Fogging or light sprinkling of water should immediately start after finishing. The gap between placing and finishing of concrete shall be minimum preferably not exceeding 30 minutes.

Subsequent to finishing, moist curing methods can involve application of additional water and retention of water in the concrete. Deficiency of curing causes micro-cracks within the body of concrete due to plastic and drying shrinkage at various periods of its life after placing and finishing. These micro-cracks widen over a period reducing the service life of the structure manifold. The corrosion of reinforcing steel when started leaves its telltale marks on the surface of concrete in the form of colored patches, cracks and spilling. The service life and appearance of concrete surfaces are greatly affected due to improper curing.

3.5.1. Apply curing based on weather condition

Control of Temperature In cold weather do not allow concrete to cool faster than a rate of 3oC per hour. Concrete shall be protected from freezing until it achieves strength of 3.5

MPa, using insulating materials. Curing methods that retain moisture, rather than wet curing, shall be used when freezing temperatures are anticipated. Wet curing is avoided in cold climate and curing methods which help in retaining water are more effective.

In hot weather high initial curing temperature will result in rapid strength gain but lower ultimate strength. Water curing and sprinkling can be used to get lower curing temperature in summer. Precautions should be used to protect against heating faster than 3oC per hour due to temperature extremes.

Table .1 Apply curing based on weather condition

Curing in Hot Weather	Curing in Cold Weather
1. Increased Evaporation - High temperatures can cause rapid moisture loss. -Cure wet burlap, plastic sheeting, or curing compounds to retain moisture.	1. **Slower Setting** - Low temperatures can slow hydration and lead to incomplete curing. - Protect the concrete with insulation blankets.
2. Timing - Start curing as soon as the surface is set (typically within a few hours after finishing).	2. Heating - Consider using heated enclosures or the addition of accelerators to speed up curing.
3.Frequency - Increase the frequency of water applications to prevent drying out	3. Temperature Monitoring - Ensure the concrete temperature stays above the minimum curing temperature (typically above 5°C or 40°F).
4. Shade - Utilize shade cloths or temporary structures to reduce direct sunlight exposure.	4. Avoid Freezing - Prevent freezing within the first 24-48 hours after pouring, as this can cause damage.

Self check -3

Direction I: Say true or False

1. The mixing of cement does not require precise measurements.
2. Curing water must meet specific environmental standards.
3. It is acceptable to use any available water for curing without consideration of its quality.
4. The proportion of materials affects the overall strength of the cladding cement.
5. Surface preparation is not necessary before applying cladding cement.

Direction II Choose the correct answer from the following alternative

1. What is the primary purpose of calculating and measuring materials for cladding cement?

A) To estimate costs
B) To ensure proper mixing proportions
C) To determine delivery times
D) To select tools

2. Which of the following is NOT a factor in selecting curing water?

A) Weather conditions
B) Water availability
C) Environmental standards
D) Color of the water

3. What is the recommended method for mixing cement in designed proportions?

A) Hand mixing only
B) Using a mechanical mixer
C) Adding water first
D) Using dry ingredients only

4. Why is it important to ensure the right curing conditions for cladding cement?

A) To speed up the construction process
B) To reduce costs
C) To achieve desired strength and durability
D) To enhance aesthetic appearance

Operation Sheet -3

Objective

To prepare and proportion materials required for producing external wall finished cast cladding cement.

Materials Needed

- Cement
- Sand

Equipment Required

- Measuring tools (buckets, scales)
- Mixing tools (concrete mixer, shovel)
- Safety gear (gloves, goggles, masks)

Procedure

Step 1: Preparation of Materials

Step 2: Measure Materials

Step 3: Mixing

Step 4: Check Consistency

Step 5: Adjust Proportions (if necessary)

Step 6: Final Mix

LAP Test-3

Name……. ID……

Date…….

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools, and materials you are required to perform the following tasks within **1** hour. The project is expected from each student to do it.

Task 1: Gather all materials in a clean, dry area.

Task 2: Measure the required quantities of cement, sand, and aggregate based on the specified mix ratio

Task 3: Add the measured dry materials into the concrete mixer.

Task4: Perform a slump test or similar method to ensure the mixture has the correct consistency.

Task 5: If the mixture is too dry, add water incrementally.

Task 6: Ensure the final mixture is uniform in color and texture.

Unite 4: Decorative Finishes and Final Touches

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

- Techniques of decorative finishes
- Inspect external wall cladding

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

- Apply Techniques for applying decorative finishes
- Identify Inspect external wall cladding

4.1 Techniques of decorative finishes

✓ Textured Finishes

Textured concrete finishes range from simple to elaborate and affordable to expensive. Some are easy to create, while others require special skills. Certain concrete textures serve functional purposes, while others are highly decorative

Stamped concrete, commonly referred to as textured or imprinted concrete, is a type of concrete finish designed to resemble brick, natural stone such as slate or flagstone, tile and even wood. Color hardener is a popular way of coloring concrete that accentuates the stamped pattern.

✓ **Polished Finishes**

To grind and **polish** the concrete, the surface is smoothed out using concrete floor grinders with diamond abrasives. The level of polish can be adjusted depending on the desired outcome by using finer or coarser abrasives. These surfaces can be commonly found in some grocery stores or big-box home improvement stores.

✓ **Varnish finish**

Varnish is a clear or colored coating that dries to a hard, protective finish. It's typically made from a resin dissolved in a solvent and may include drying oils. Varnish is used to enhance the appearance of wood and other materials while providing protection against moisture, UV rays, and wear. A varnish finish is a versatile and effective way to protect and enhance the beauty of various surfaces, particularly wood. By selecting the appropriate type of varnish and following proper application techniques, you can achieve a durable and aesthetically pleasing result.

The Benefits of Varnish Finish is Durability: Provides a hard, protective layer that resists scratching and wear, Aesthetic Appeal: Enhances the natural beauty of wood by adding depth and richness to the grain.

4.1.1. Method of finishing

To obtain an even surface on walls after the formwork has been removed a cement wash is brushed into the surface in 2 coats.

The area to be coated should be thoroughly wetted before the wash is brushed on. This coat is rubbed Cement wash

Lime, calcium chloride or common salt may be added to the cement and water slurry to make it stronger and improve the adhesion.

Before applying any form of cement wash or paint the concrete surface is cleaned and free from any oil, grease, dust or loose material and is well wetted as curing is essential to ensure complete hydration of the cement base

Finishing external wall cladding with natural stone involves several methods that enhance both aesthetics and durability. The Methods are included but not limited

- ✓ Dry-Stacked

The dry cladding method creates a cleft of around 30 to 45 mm (1”-1.5”) in between face of the wall and stone covering, providing a layer of air cushion that acts as a thermal barrier. · The appearance of stone used in dry cladding work looks spotless and aesthetically pleasing.

Fig: 4.1 Dry-Stacked

- ✓ Thin Veneer

Natural stone veneer or real sawn thin stone is created from real, quarried stone that is sliced into thin pieces or otherwise cut to fit the needs of your design. Since it's 100% real stone, it is naturally weather proof

Fig: 4.1 Dry-Stacked

✓ Tumbled Finish

Tumbled finish stone external house cladding is a construction technique that uses a natural stone with a tumbled finish to create a rustic, aged appearance on the exterior of a house

Fig: 4.1 Dry-Stacked

✓ Polished Finish

Polished stone is one of the many finish options for stone cladding, which is a thin layer of stone applied to an exterior wall to give the appearance of a stone building. Stone cladding can be made from natural or artificial stone, and comes in a variety of finishes that can mimic the look of slate, brick, and other stones

Fig: 4.1 Dry-Stacked

✓ Honed Finish

A honed finish stone external house cladding wall is a stone surface that has been ground and sanded to create a smooth, matte appearance. Honed stone is a popular choice for stone walling because it is low maintenance and marks are less visible.

Fig: 4.1 Honed Finish

- ✓ Chiseled or Split Face

  Split face Stone cladding is designed to create a Country style finish. It appears that rough pieces of stone have been chiseled to create this appearance. Our Split face stone gives an Old World Look to a structure

Fig:4.1 Chiseled or Split Face

✓ Natural Cleavage

Natural stone refers to organic rock that is quarried from the earth and used for building or decorative purposes.

Fig:4.1.Chiseled or Split Face

4.2. Inspect external wall cladding

Regular inspections and maintenance ensure the longevity and performance of cast cement cladding. If significant issues are found, consult with a professional for repairs or replacements.

✓ **Discoloration**

Discoloration of concrete can result from improper concrete mix specifications. Coloring agents or aggregates of differing alkalinity in the mix can cause color changes in the concrete material. A change in the color of the concrete from its intended color is generally not critical to the structural capacity, but the presence of stains can indicate moisture penetration. Rust stains from corroding reinforcement or from leaking pretension cables can indicate structural deficiency. Dusting of concrete surfaces can result from a design specification that requires placing plastic concrete over a no absorptive surface. Excessive bleeding will cause water, cement particles, and fine aggregates to rise rapidly to the surface creating a weak surface layer that powders under any traffic and is easily scratched. If bleed water is present when finishing techniques are conducted, mixing excess water into the top surface of the concrete can cause dusting

Fig: 4.1.Discoloration of concrete wall

- ✓ **Efflorescence**

Efflorescence Including aggregates in the mix that are reactive with the cement can cause a deposit of salts to form on the surface as bleed water rises to the surface and evaporates. Excessive amounts of water in the mix compounds the condition. Repeated wetting and drying of in service concrete can leach salt deposits from the concrete mass and deposit them on the surface through cracks or other surface penetration

Fig: 4.1.Efflorescence on a concrete wall.

- ✓ **Flaking**

Flaking is the delaminating of the surface concrete from the subsurface mass. It occurs because of improper construction practices or freezing and thawing of permeable concrete .High water content of the concrete mix can cause a concentration of fine aggregates and water at the surface.

If finishing techniques are carried out while excess bleed water is still on the surface, delaminating of the surface layer can later occur.

Fig: 4.2.Flaking

4.3. Handling and disposing of waste materials.

4.3.1. Preparing and handling work materials

Handling is the act of touching, feeling, holding and moving something. The act or process of packing and shipping something. It includes the preparation, handling, sorting, stacking and disposal of Install and produce external wall finished cast cladding cement

Generally, the delivery, storage and handling of materials shall comply with the requirements of ES 1653 including the following:

Keep the site clean and tidy in order that the checking, handling and storage of materials and components can be carried out speedily and effectively.

Program deliveries in accordance with the contract program, to reduce site storage to a minimum.

Prepare storage arrangements for each item in advance of delivery.

Unload straight into the designed storage space.

Delivery:

Carry out detail checks on delivery in accordance with the criteria set out in ES 1653. In particular:

Check quantities during unloading.

Check for damage to manufactured components during unloading.

Assess moisture content during unloading on overall components.

Keep materials dry during delivery.

Reject items which fail on any aspect of condition or specification.

Handling:

When handling, ensure that the items are not subject to stresses greater than those that they will sustain once installed. In particular:

Support flat, planer items at all corners.

Support linear items adequately along their length to avoid undue 'bow'.

Storage: a. Provide storage in accordance with the criteria set out in ES 1653 to ensure that materials and components are maintained free from damage and are in conditions suitable for their specified moisture content.

Store materials by complying with the minimum height (usually 15 cm) above ground surface.

Stack materials and components in accordance with the methods stated in ES 1653, and provide air circulation between stacks.

Protect against exposure to weather and contact with damp or wet surfaces.

Cover stored materials and components with flexible or rigid sheets until ready for use for protection from moisture.

Place and anchor cover in a manner that will provide good cross ventilation between the top of the items stored and the covering.

4.3.2. Waste disposal of material

Solid waste management: A systematic administration of activities that provide for the collection, source separation, storage, transportation, transfer, processing, treatment and disposal of solid waste.

- ✓ **Classifications of solid waste**

Solid waste can be classified into two categories by its characteristics.

These are:

Organic solid waste: - Organic solid waste: Wastes that are generally biodegradable and decompose in the process of which emits offensive and irritating smell when left unattended.

Inorganic Solid waste:- Solid matter that does not decompose at any rate This category of waste matter may be combustible depending on the type of the nature of the material they constitute.

- ✓ **Functional Elements of solid waste management system**

There are six functional elements in the activities associated with the management of solid wastes from the point of generation to final disposal site. These are:

Waste generation

Those activities in which materials are identified as no longer being of value and are either thrown away or gathered together for disposal

On-site handling (sorting, storage and processing)

On-site handling, storage, and processing: activities associated with the handling, storage, and processing of solid wastes at or near the point of generation Collection.

Those activities association with the gathering of solid wastes and the hauling of wastes to the location where the collection vehicle is emptied.

Transfer and transport

Those activities association with (1) the transfer of wastes from the smaller collection vehicle to the larger transport equipment and (2) the subsequent transport of the wastes, usually over long distance, to the disposal site.

Processing and recovery

Those techniques equipment and facilities used both to improve the efficiency of the other functional elements and to recover useable materials, conversion products, or energy from solid wastes.

Disposal

Those activities associated with ultimate disposal of solid wastes Interrelationship of functional elements comprising a solid waste management system.

Self cheek -4

Direction I Multiple choice

Instruction: - choose the write answer from the given alternative

1. What is the primary purpose of applying decorative finishes to external wall cladding?

A) To enhance structural integrity
B) To improve aesthetic appeal
C) To increase insulation
D) To reduce weight

2. Which of the following is NOT a type of decorative finish mentioned in the unit?

A) Paint
B) Stucco
C) Concrete
D) Wallpaper

3. What should be done before inspecting external wall cladding?

A) Apply a protective coating
B) Clean the surface
C) Install additional fixtures
D) Remove all existing finishes

4. What is a critical step in ensuring the quality of decorative finishes?

A) using the cheapest materials available
B) Following the manufacturer's instructions
C) Skipping the drying time
D) Mixing different types of finishes

5. During the final touches, which aspect is crucial for the overall appearance of the cladding?

A) Random application of finishes
B) Uniformity and consistency in application
C) Neglecting to check for defects
D) Using multiple contrasting colors

Operation sheet-4

Objectives

- -Prepare surfaces for cladding application.
- Apply external wall finished cast cladding cement.
- Ensure quality and compliance during the application process.

Tools and Equipment Needed

1. Hand Tools

- Trowel
- Float
- Spirit Level
- Measuring Tape
- Chisel

2. Power Tools

- Mixer
- Circular Saw
- Drill

3. Safety Equipment

- Safety goggles
- Gloves
- Hard hat
- Dust mask

Procedure

1. Site Preparation
2. Surface Preparation
3. Mixing Cladding Cement
4. Application of Cladding Cement
5. Curing Process
6. Quality Check
7. Cleanup

Lab test -4

Name……. ID……

Date…….Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools, and materials you are required to perform the following tasks within **1** hour. The project is expected from each student to do it.

Task 1: Inspect the cladding surface for any defects or irregularities.

Task 2: Ensure the surface is dry before applying any finishes

Task 3: Choose appropriate decorative finishes based on design requirements and environmental conditions.

Task4: Use a trowel to apply the coating evenly

Task 5: Measure and mark the layout for tile placement.

Task 6: Apply adhesive and set tiles according to the design

Task7: Apply sealants to protect finishes from weather and wear

Task 8: Conduct a thorough inspection of the finished surface.

Task 9: Check for uniformity in color and texture.

Task 10: Make necessary touch-ups as needed.

Task 11: Clean all tools and equipment after use.

Task12: Dispose of any waste materials in accordance with safety regulations.

Task 13; Store leftover materials properly.

Reference

- The Complete Guide to Sustainable Cladding Solutions _ Fairview)
- Types of House Cladding - Best House or Building Cladding Materials & Options in 2024
- Structural integrity PDF
- Installation Techniques for Modern Buildings PDF
- STANDARD TECHNICAL SPECFICATION
- Guide to concert casting.
- concrete cladding - monitoring building condition February 2018
- Quality control in cleaning Services April2007
- Fire Safety Of Façade Cladding
- Wall Cladding Installation Guide Order online at www.wpc-decking.co.uk
- Stone Cladding Types, Designs, and Installation Methods HTLM

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