BAR BENDING AND CONCRETING

Level-II

Learning Guide -37

Unit of Competence: Erect Pre-cast Concrete Structural & Cladding Units

Module Title: Erecting Pre-cast Concrete Structural & Cladding Units

LG Code: EIS BBC2 M11 LO1-LG-37

TTLM Code: EIS BBC2 TTLM 1019v1

LO 1: Plan and prepare

Instruction Sheet	Learning Guide #37

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

- Interpreting information/drawings
- Adopting safe and healthy working practices/ Safety requirement
- Selecting materials, components, tools and equipment
- Preparing form and erecting pre-cast concrete structural units and cladding components

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, **you will be able to –**

- Interpret information or drawings
- Adopt safe and healthy working practices
- Select materials, components, tools and equipment's
- Prepare form and erect pre-cast concrete structural units and cladding unit associated components

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 6.
3. Read the information written in the information "Sheet 1, Sheet 2, Sheet 3 and Sheet 4," **in page 3, 8, 15 and 21** respectively.
4. Accomplish the "Self-check 1, Self-check t 2, Self-check 3 and Self-check 4" **in page 7, 14, 20 and 28** respectively
5. If you earned a satisfactory evaluation from the "Self-check" proceed to "Operation Sheet 1and Operation Sheet 2 **in page 29.** And Operation Sheet 3" **in page 30.**
6. Do the "LAP test" **in page 30**

Information Sheet-1	Interpreting information/drawings

1.1 Interpreting drawing

Design and construction personnel in all areas of employment are likely to be involved in building design and construction. This includes concrete, structural steel and timber design and construction detailing. This course therefore seeks to introduce the student to these commonly encountered areas of structural engineering and building technology. The course provides a broad overview of current building construction practice, embracing the structural, architectural and building services aspects. There is also a need to convey details via sketches and drawings as a necessary part of achieving a final result in engineering design.

1.1.1 GENERAL REQUIREMENTS

Precast concrete units shall be designed and fabricated by an experienced and acceptable precast concrete manufacturer. The manufacturer shall have been regularly and continuously engaged in the manufacture of precast concrete units similar to that indicated in the project specifications or drawings.

1.1.2 Shop Drawings

Drawings for Standard Precast Concrete Units

The drawings for standard precast concrete units shall be shop drawings furnished by the precast concrete producer for approval by the customer. These drawings shall demonstrate that the applicable industry design standards have been met. Installation and construction information shall be included on shop drawings upon request. Details of steel reinforcement size and placement as well as supporting design calculations, if appropriate, shall be included. The precast concrete units shall be produced in accordance with the approved drawings. Drawings shall indicate assumptions used in the design of standard units. It is the responsibility of the project's engineer-of-record to verify that the design assumptions are suitable for the proposed application.

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Drawings Submitted by the Customer

The customer or customer's agent (specified) may provide the precast concrete manufacturer with drawings for custom-made precast concrete units. Drawings shall be prepared and stamped by a licensed professional engineer. The customer or customer's agent may consult the precast concrete manufacturer during the design process on relevant production practices that may affect the design, production, handling and installation of the custom-made precast concrete unit. The customer or customer's agent accepts all liability associated with the use of the provided drawings.

1.2 how to read engineering drawings

Engineering drawings are typically used as visual tools in the creation of homes, bridges, and other buildings. While these drawings can be quite straightforward to individuals who are skilled in the field of engineering or architecture, they can be quite difficult to interpret for laypeople. Knowing how to read engineering drawings will help provide you with a better idea of the building plans.

1.2.1 Familiarize yourself with the scale of the drawings.

Understanding how large or small certain items are essential when reading engineering drawings. While most engineering drawings are created in "scale" versions of 1/4-1/8 inches (.55-.275 centimeters) per foot, other scales may be used for very large creations. Always determine the scale of the drawing before examining it in detail. If the scale is not obviously evident on the drawing, consult with the engineer who drew it for clarification.

Fig. 1.1: scale of the drawings

1.2.2 Understand the basic symbols used in the engineering drawings.

As these drawings are done on such a small scale, the use of symbols is often required. While many symbols exist, understanding a few of the basics can be very helpful when reading engineering drawings. Some of the most common symbols used in these drawings include rectangles, circles,

and triangles. As with determining the scale, consulting with the engineer who created the drawing can provide great insight as to the symbols used.

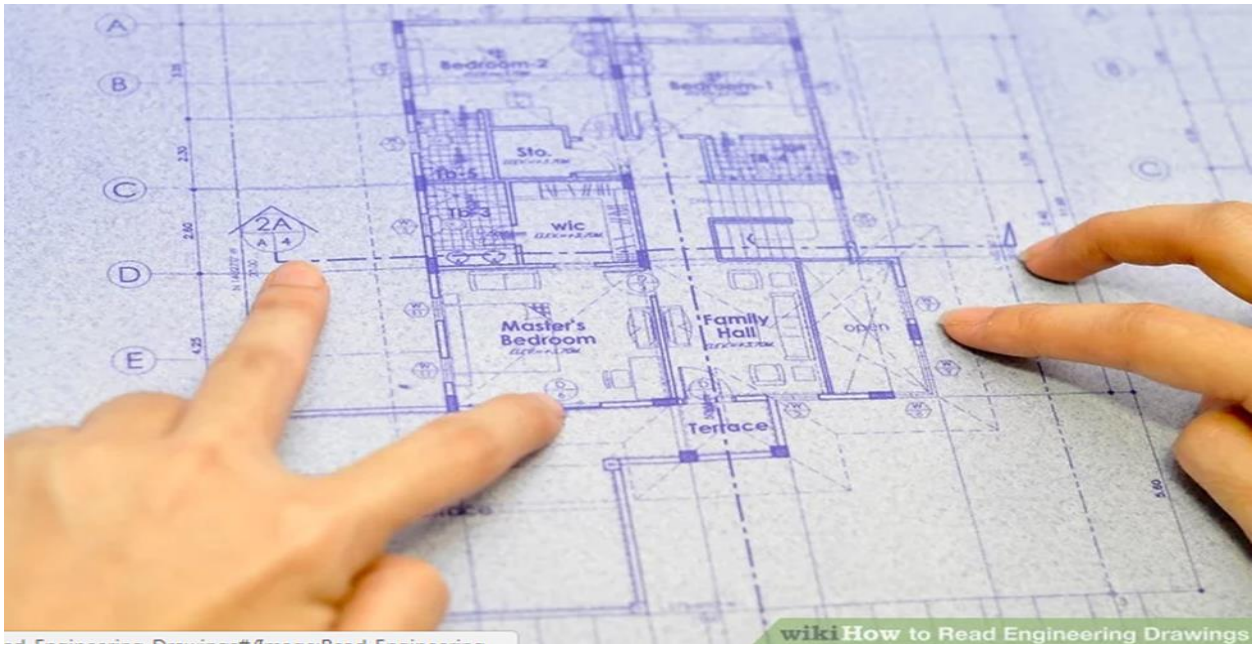

Fig.1. 2: Understand the basic symbols

1.2.3 Look for circled numbers.

As discussed previously, engineering drawings are typically done on a scale so small that creating detail is almost impossible. Because of this, engineers often add circled numbers to certain parts of the drawings. These circled numbers indicate that the area identified is shown in greater detail on another page.

Fig.1. 3: indicate that the area identified

1.2.4 Identify specific abbreviations.

Abbreviations are a useful tool for engineers. Like symbols, they can indicate shapes, processes, and even dimensions through a few letters. Some of the most common abbreviations used in engineering drawings include DP, which stands for depth, and DIA, which stands for diameter.

Fig. 1.4: the most common abbreviations

1.2.5 Work with colleagues.

When all else fails, consult with other professionals to better clarify the drawings. While it may be embarrassing to admit that you are having difficulty interpreting the drawing, those who regularly work with and understand the drawings will help you read them. Ask "in the know" individuals on the project to clarify anything you do not understand; better that this happens in the early stages of a project than to encounter a mistake farther into a project because of improperly reading engineering drawings.

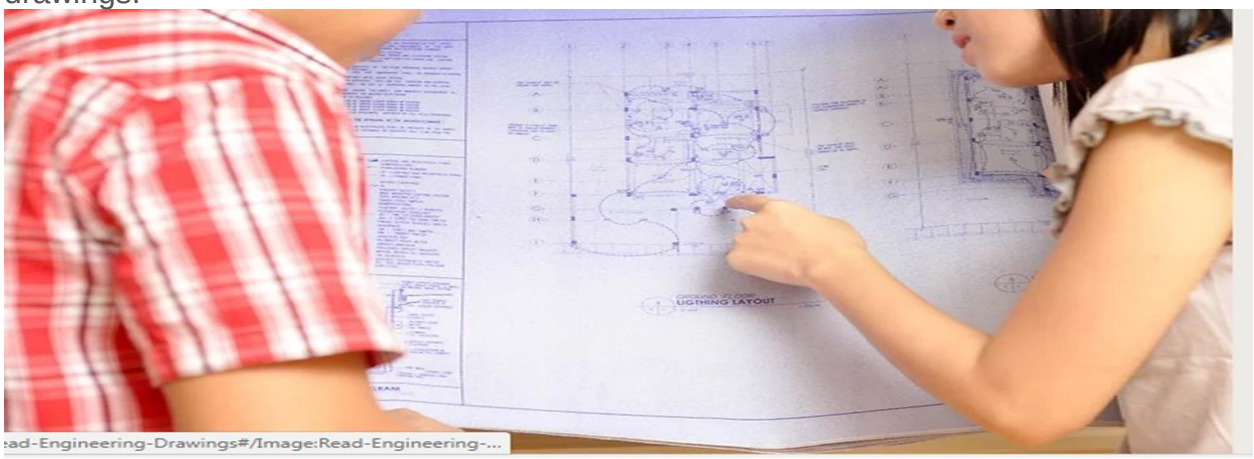

Fig. 1.5: understand the drawings will help you read them

Self-Check -1	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Drawing shall be prepared and stamped by any persons.
   A. True
   B. False
2. Write the purpose of drawing in precast concrete construction

Note: **Satisfactory rating - 3 points** **Unsatisfactory - below 3 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

List of Reference Materials

1. www.wikihow.com/Read-Engineering-Drawings

Information Sheet-2	Adopting safe and healthy working practices/ Safety requirement

1. Introduction

Safety is the first essential requirement and every personnel must learn the safety measures even before he/she starts working on a machine or on equipment's. Safety is an attitude, a form of mind of worker. If the attitude of worker towards safety is good and he/she is safety conscious, then he/she him/her self will develop the safe working habits. Before you can use equipment and tools or attempt practical work in a workshop you must understand basic safety rules. These rules will help keep you and others safe in the workshop.

- **Safety** is a precaution to avoid accident, right way of doing to avoid accident , follows direction to prevent wastage of time, energy & money
- **Care** is a technique of properly handling tools, equipment's & materials.

To protect ourselves from the accidents of hand tools & machines in the workshop it's better to consider the following safety care and know safety sign.

2. classification of safety

safety can be classified as; personal safety(PPE & HSE), safety hand tools & equipment's, safety working area, safety rules & regulation of in the construction site and first aid.(plaster, destinficant, bandage , ointment).

2.1 personal safety(PPE & HSE).

The primary important to protect the work

man from accidents is to identify possible hazards and take the necessary safety measures to eliminate the hazardous. Before you go to work on any job, make sure

your entire body is properly protected

and provided other

personal protective equipment

and Healthy safety equipment.

Fig 2.1 Personal Protective Equipment's

- **Helmet; Protects** the carrier from down falling items. t should be a must for everybody who works or moves on a building site
- **Ear protection;** Protects the carrier from damages of the ears.
- **Safety shoes ;** Protects the workers feet from colds, chemical, and mud in the working area.
- **Safety glass ;** protects eye against chips and dust parking around from the work piece
- **ask (respiratory equipment):** Protects the worker from other endangering object and dust during construction.
- **love:-**Protects the workers from oils, chemicals, and dust And other dangerous material that affect the skin**.**

2.1.2 safety hand tools & equipment's

- **Do not force the tool.** Use the correct tool for your application. The correct tool will do the job better and safer at the rate for which it is designed.
- **Do not use the power tool if the Power Switch does not turn it on or off.** Any tool that cannot be controlled with the Power Switch is dangerous and must be replaced.
- **Disconnect the Power Cord Plug from the power source before making any adjustments, changing accessories, or storing the tool.** Such preventive safety measures reduce the risk of starting the tool accidentally.
- **Store idle tools out of reach of children and other untrained persons.** Tools are dangerous in the hands of untrained users.
- **Maintain tools with care.** Keep cutting tools sharp and clean. Properly maintained tools with a sharp cutting edge are less likely to bind and are easier to control. Do not use a damaged tool. Tag damaged tools "Do not use" until repaired.
- **Check for misalignment or binding of moving parts, breakage of parts, and any other condition that may affect the tool's operation.** If damaged, have the tool serviced before using. Many accidents are caused by poorly maintained tools.
- **Use only accessories that are recommended by the manufacturer for your model.** Accessories that may be suitable for one tool may become hazardous when used on another tool.

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

3. Human Causes

- Accidents may occur while working on unsafe or dangerous equipments or machineries possessing rotating, reciprocating and moving parts.
- Accidents occur while operating machines without knowledge, without safety precautions, without authority, without safety devices.

- Accidents generally occur while operating or working at unsafe speed.
- Accidents may occur while working for long duration of work, shift duty etc.
- Accidents commonly occur during use of improper tools.
- Accidents may occur while working with mental worries, ignorance, carelessness, nervousness, dreaming etc.
- Accidents occur because of not using personal protective devices.

3. Environmental Causes

- Accidents may occur during working at improper temperature and humidity causes fatigue to the workers so chances of accidents increases with workers having fatigue.
- The presence of dust fumes and smoke in the working area may causes accidents.
- Poor housekeeping, congestion, blocked exits; bad plant layout etc. may cause accidents.
- Accidents occur due to inadequate illumination.

4. Mechanical Causes

- Continued use of old, poor maintained or unsafe equipment may result in accidents.
- Accidents commonly occur due to use of unguarded or improper guarded machines or equipment's.
- Unsafe processes, unsafe design and unsafe construction of building structure may lead to accidents in the plant.
- Accidents occur due to improper material handling system and improper plant layout
- Accidents may occur due to not using of safety devices such as helmets, goggles, gloves, masks etc.

5. safety working area

Working place or area is whole building/construction/ site including tools, equipment, machines, storerooms, etc. Within the general working place there is a personal working area /space/, where someone is building up a wall or other related activities. Working space is essentially required for all

construction workers, to accommodate materials and equipment's for the process; therefore, it is a crucial and necessary to keep them all in proper manner.

A neat and tidy site safes time, eases the work and avoids accidents. If things like tools, battens, boards, stones, cables, steel bars etc. are not used or kept improperly they are obstacles for the construction process and can be the cause for accident.

What does an accident mean?

Personally:

Worries for the family

Consequences of the

Accident may:-

- For short times

OR

- Permanently

In worst case

Dead

- Permanent pain

OR

- Handicap

- Loss of salary so that financial deficiency for medical treatment & other expenses /unemployment/

Figure2.2. accident result.

6. Safety Rules and regulations.

6.1 General Safety Rule

General safety rule is very important to reduce the accident while you working in workshop. Some of them are listed below,

- ***Follow directions*:-**understanding the procedures of using by hand tools & machines.

- **Stay alert.** Watch what you are doing, and use common sense when operating a power tool. Do not use a power tool while tired or under the influence of drugs, alcohol, or medication. A moment of inattention while operating power tools may result in serious personal injury.

- **Use safety equipment.** Always wear eye protection. Dust mask, non-skid safety shoes, hard hat, or hearing protection must be used for appropriate conditions.
- ***Always dress properly***: - Dress properly for your work. While you must wear your aprons are provided so that you can work on the machines. Remove any jeweler, neckties, chains, bracelets, and rings. Roll up your sleeves and tie any hair back in a ponytail before beginning any work
- ***Keep the shop clean: -*** Put your tools back where they belong when you finished.
- **Keep the floor clear of debris and sawdust:-** the floor should be clear of scrap blocks, excessive material, and sawdust. Keep projects, sawhorses, and other equipment and materials you are using out of travel lanes. Wipe up any spilled liquids immediately.
- ***Learn to use the tools correctly***
  - ✓ Understanding using of hand tools in proper ways.
- ***Avoid house play***
- ***Report all accidents***
- ***Practice lending a cheerful helping hand when requested by someone.***

Be thoughtful and helpful toward other students in the class. Caution them if they are violating a safety rule. This is one of the most important rules in that all of you have responsibility for each other's safety and well-being in the class.

A building site should have a first aid box which as minimum contents: -

Plasters;

Bandages;

Ointments;

Disinfectant.

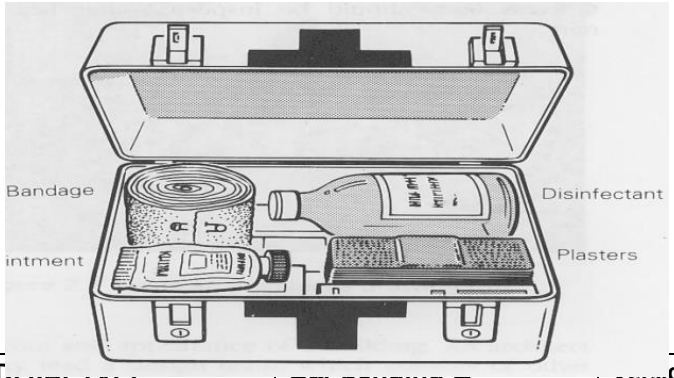

Fig 2.3. First aid

Summary:-

- Following proper working procedures & rules of safety and proper order of materials, tools, equipment's, etc., in site, avoids accidents and eases the work.
- secure health for workers on site.
- The human body is a good conductor. Hence, be careful current from more than 0.05 A can cause death.

Self-Check -2	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What are personal protective equipment's?
2. Mention causes of accidents
3. What are safety rules and regulations?

Note: **Satisfactory rating - 3 points** **Unsatisfactory - below 3 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet-3	Selecting materials, components, tools and equipment

3.1 Material selection

Design of connections to transmit forces due to shrinkage, creep, temperature change, elastic deformation, wind forces, and earthquake forces require special attention. Details of such connections are especially important to insure adequate performance of precast structures.

Manufacturers except as otherwise specified, material shall conform to the following section.

- ✓ Cement
- ✓ Water
- ✓ Aggregates
- ✓ Admixtures
- ✓ Air-Entraining
- ✓ Accelerating, Retarding, Water Reducing [Moderate to High]
- ✓ Reinforcement bar

Forms for manufacturing precast concrete units shall be of the type and design consistent with industry standards and practices. They should be capable of consistently providing uniform products and dimensions. Forms shall be constructed so that the forces and vibrations to which the forms will be subjected cause no damage to the precast concrete unit. Forms shall be cleaned of concrete build-up after each use.
Form release agents shall be applied according to the manufacturer's recommendations and shall not be allowed to build up on the form casting surfaces.

3.2 components of precast concrete

Precast concrete Is prefabricated, pre-casted or before cast in situ the element produces on the production site

- **building frame unit**
  Cladding unit wall, wall, floor(slab) unit, beam, column, stair, segmental components, culvert, retaining wall, pole, piles, bridge, sea defenses elements, railway elements, run way, grid, drainage and other special product etc.

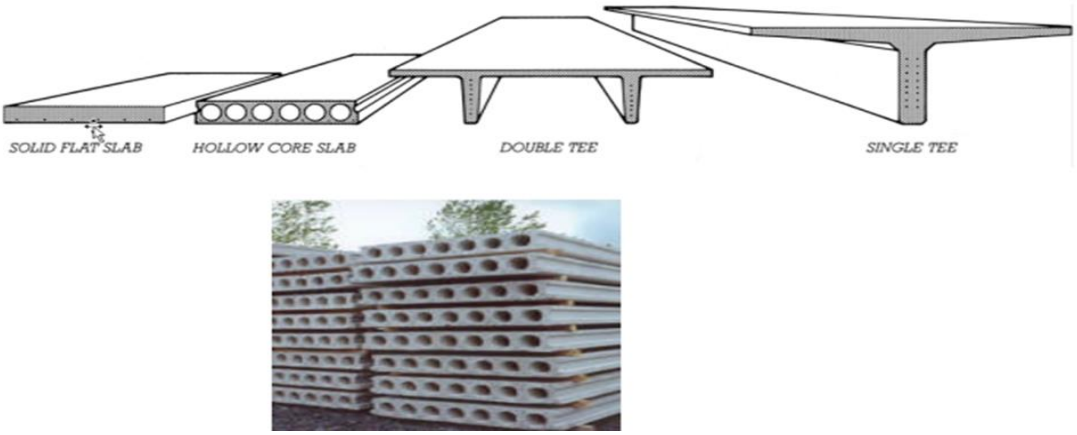

Fig. 3.1: Precast slab

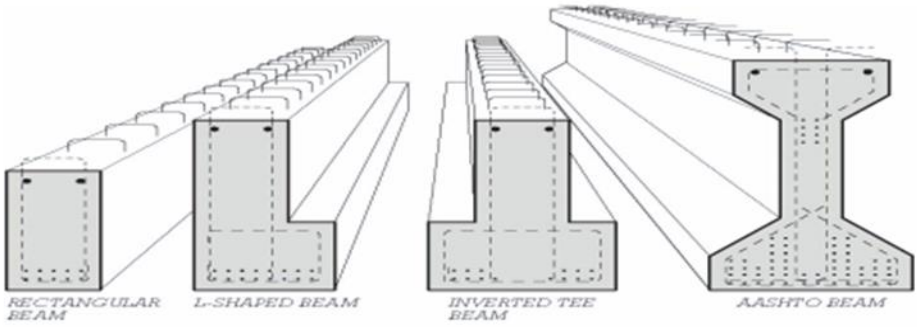

Fig. 3.2: Precast beam and girders

Precast columns

Inverted Tee beams supported on precast columns

Fig. 3.3:Precast columns

Fig. 3.4: Precast walls

Precast concrete Stairs

Uniquely shaped structural elements for a sports stadium

Fig. 3.5: Other elements

- Before starting the production work equipment and services are described as wall as
    1. Mould of design and construction
    2. Reinforcement location
    3. Casting procedure
    4. Handling techniques
    5. Quality insurance procedure (filer of materials)
    6. And troubles shooting (to solve a problem currently)

3.3 Preparation of plant, tools and equipment type

Prepare and operate equipment/machinery/tools in precast concrete operations. This standard covers the preparation and operation of equipment /machinery /tools in precast concrete operations. The equipment is used to undertake work activities, and you are expected to be able to prepare it for operation. You will also monitor the equipment during operation and identify any indications of a or poor performance. In addition, you have to ensure the equipment is clean and clear from obstructions, although you will not undertake routine or emergency maintenance of the kind carried out by maintenance engineers.

- **Prepare and operate equipment/machinery/tools in precast concrete operations**

  Knowledge and understanding you need to know and understand:-

  - ✓ the relevant health and safety responsibilities and obligations
  - ✓ the relevant health and safety procedures that need to be followed
  - ✓ how to confirm the correct specifications for the work being undertaken
  - ✓ the level of detail required in a specification
  - ✓ the equipment, materials, and work procedures that should be used for different jobs
  - ✓ where to obtain information on the safe use of equipment/machinery/tools
  - ✓ the equipment to use for different work activities
  - ✓ how to avoid damaging equipment through incorrect use
  - ✓ how different types of equipment/machinery/tools can be prepared for different requirements
  - ✓ how to operate different types of equipment/machinery/tools
  - ✓ the maintenance requirements of different types of equipment/machinery/tools
  - ✓ the different monitoring methods for different types of equipment/machinery/tools
  - ✓ the type(s) of items that could damage the equipment/machinery/tools
  - ✓ the type(s) of problems that can occur with the equipment/machinery/tools, and the standard operating procedures for dealing with them
  - ✓ the information systems that should be used
  - ✓ the importance of using the information systems

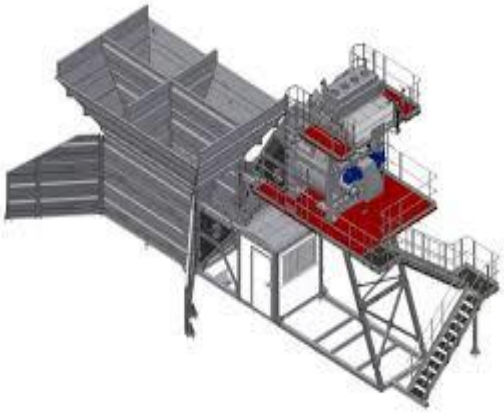

Fig.3.6: different types of equipment's

- **Necessary tools and equipment's**
  - ✓ Mixer
  - ✓ Immersion vibrator in site
  - ✓ Table vibrator
  - ✓ · Conveyer
  - ✓ · Concrete pump
  - ✓ · Welding machine
  - ✓ · Drilling machine
  - ✓ Crane/climbing crane/a heavy duty lifting machine that rise itself as the building rise
  - ✓ Cutting machine: pneumatic powder diamond circular saw the same of slice a control joint in concrete pavement

Self-Check -3	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. ----------Is prefabricated, pre-casted or before cast in situ the element produces on the production site
   A. In situ cast
   B. Precast concrete
   C. Stone
   D. All
2. ----------is used to lifting precast concrete unit.
   A. Mixer
   B. Table vibrator
   C. Crane
   D. Drilling machine
3. Which one of the following materials is not used to produce precast concrete?
   A. Cement
   B. Aggregate
   C. Admixtures
   D. None

Note: **Satisfactory rating - 5 points** **Unsatisfactory - below 5 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet-4	Preparing form and erecting pre-cast concrete structural units and cladding components

4.1 Preparing form and erecting pre-cast concrete structural units

4.1.1 Introduction

The concept of precast (also known as “prefabricated”) construction includes those buildings, where the majority of structural components are standardized and produced in plants in a location away from the building, and then transported to the site for assembly. These components are manufactured by industrial methods based on mass production in order to build a large number of buildings in a short time at low cost.

Fig. 4.1: Precast Concrete production area

Precast concrete construction system has its own characteristics which influence the layout, span length, construction depth, and stability system to a great extent. In precast concrete construction, majority of structural members are manufactured in manufacturing plants away from the construction site. After that, they are delivered to the project site to be erected.

Various connections have been developed to connect different types of structural elements like beam to column connection and panel to panel connection. In this manner, the imposed loads are transferred from superstructure to the foundation.

Designers should consider the possibilities, restrictions, detailing, manufacturer, transport, erection and serviceability stages before finalizing the design of precast concrete structure.

4.1.2 Advantages and disadvantages of precast concrete unit

- **Advantages of precast concrete unit**

✓ To save time at erection & assembling or there is speed in construction

- ✓ To have very smooth or better surface finish
- ✓ Duration of curing is finishes at production site
- ✓ Very safe at uncomfortable condition during construction
- ✓ To help cost minimize in case of 20% form work is minimize
- ✓ Repetitive use of shuttering or false work is limited as to get damage due to frequent cutting, nailing
- ✓ There is better quality control shape, size, etc. of precast than in situ.
- ✓ The construction is not affected due to weather rain, wind, etc…
- ✓ The work at site is reduced to minimum work is more reliable & clear
- ✓ As away to ensuring higher quality product of greater accuracy then can be obtained
- ✓ B/c of faster completion & w/c means early return of the investment etc…

- **Disadvantages of precast concrete unit**

- ✓ To need very high no of skill man, engineers, designers, consultants, contractors, specialist & others at the work
- ✓ To required high percentage of safety at all works.
- ✓ Very difficult during lifting, handling, transporting operation & the cost are incurred.
- ✓ There is risk at failed of the site
- ✓ Joint may be problem
- ✓ Member may be damaged though in correct repeated handling

4.1.3 Precast concrete production procedure

- **Plan & prepared**
  - ✓ obtained confirmed and applied
    - Plans
    - Specification
    - Quality requirement
    - Operational detail
  - ✓ follow safety rule
  - ✓ selecting plant totals & equipment's.
  - ✓ Calculate material quality requirement.
- **Prepared concreting materials**
  - ✓ Determined location reinforcement steel based on the recommendation.
  - ✓ Select formwork to what required on the job.
  - ✓ used fixing 9 joint or assembled.
- **Construct and install reinforcement with set out concrete work**
  - ✓ cut & bend reinforcement fabric bar recommended by the designer.
  - ✓ tied and fixed fabric bar with recommendation by the designer.
  - ✓ Clearance of form work.
- **Erect form work**
  - ✓ Clear the work area for safe erection.
  - ✓ Set out the form work with recommendation by the designer.
  - ✓ Assemble and erected before that to remove the debris, saw dusts & other waste materials.
- **Carry out concrete work**
  - ✓ Transported concrete correctly with recommendation by the designer.
  - ✓ The concrete properly leveled & place.

- ✓ Positioned control joints & dowel joints are applied properly.
- ✓ Finished & curing process and that stripping form work.

4.1.4 Limitation of the precast concrete unit

- As the pre-cast element to be have monolithic on erection extra reinforcement may be necessary in same case.
- Extra reinforcement is required to take care of handling and erection stresses.
- Temporary props may be required in same case before the in situ concrete joint achieved strength.
- The crack may be develops at the joint b/n the precast & in situ concrete due to shrinkage & temp Stresses to overcome them extra steel are required across the joint.
- As there as chances of leakage (seepage) though the joint b/n the precast concrete components extra. Care is required to make them leak proof.
- Precast element may have smooth & groove teeth for jointed with other element.

4.1.5 **Compressive strength in precast concrete unit**

The shapes are ready to pretension the steel in the precast element for greater structural efficiency w/c translate in to the longer span, lesser depth, & lower weight than for comparable RCC elements.

Curing method is aiding & accelerating reaction of concrete by the application of steam. In precast concrete elements is usually **steam curing**

Steam curing couple with the use of type III or (high early strength)

With steam curing 10-12 hr. after pouring the concrete reaches compressive strength of 24-28 Mpa

4.1.6 Types of Precast Systems

In order to understand the construction of precast concrete structure, different precast systems shall be known. There are four major types of precast systems which are classified based on the on the load bearing structure:

1. Large Panel System

Large panel systems are useful for the construction of apartments and hotels. It consists of large walls and floor concrete panels connected in the vertical and horizontal directions.

Both horizontal and vertical panels withstand gravity loads. There are three arrangements of large panel system based on wall layouts which include cross-wall system, longitudinal-wall system, two-way system.

Fig. 4.2: Large Panel Precast Concrete System Construction

2. Frame System

It is suitable for the construction of car parks, stadia, and offices. Precast frames can be constructed using either linear elements or spatial beam-column sub assemblages.

Precast beam-column sub-assemblages have the advantages that the connecting faces between the sub-assemblages can be placed away from the critical frame regions.

However linear elements are generally preferred because of the difficulties associated with forming, handling and erecting spatial elements.

Fig. 4.3: Precast Concrete Frame Structure erected within four weeks

3. Slab-Column System with Shear Wall

In this system, gravity loads supported by slab-column structure whereas shear walls withstand lateral loads. There are two types of slab-column system with shear walls namely; lift slab system with walls and pre-stressed slab-column system.

Fig. 4.4: Precast Column-slab System with Shear Walls

4.2 Pre-cast cladding unit

Is a material used as the exterior wall including of a building.

The cladding typifies a paradox of building these part of building that are exposed to our view are also those that are exposed to wear & weathering.

4.2.1 Function of cladding

- **The primary function of cladding**

Is to separate the indoor environment of a building from the outdoor in such way that indoor environmental condition can be maintain at level; situation for the building intended use.

- ✓ Keep water out: - must be prevent the entry of rain, snow, ice, in to the building.
- ✓ Preventing air loss: - must be prevent the unintended passage of air b/n indoor & outdoor.
- ✓ Controlling light: - must be control the passage of light b/c sunlight includes destructive ultraviolet wave length that must be kept off human skin & away from interior materials that will fade or disintegrate.
- ✓ controlling the radiation of heat
- ✓ controlling the conduction of heat
- ✓ Controlling sound: - serves to isolate the inside of building from outside.

- **The secondary function of cladding**

✓ Resisting wind force: - must be adequately strong& stiff to suction the pressure & suction that will be placed upon it by wind.
✓ Controlling water vapor:- must retard the passage water vapor.
✓ Adjusting to movement: - they area d/c of forces tugging & pushing both the frame b/n & the cladding. Therefore thermal expansion & contraction and moisture expansion & contraction structural defection.
✓ resister fire
✓ weathering grace ful

4.2.3 Sealant joint in cladding

Systems that do not use sealant as water barriers in the face of the wall generally use them to seal joints in the air barriers behind the face.

The role of a sealant into fills the joint b/n cladding components preventing the flow of air or water. Sealant joints width is usually 9-19mm but can be as small as 6mm & same time's ranges up to 25mm.

- **Materials of sealant**

✓ Gunn able sealant materials: mastshe (sticky liquid injected by sealant gun)
✓ Solid sealant materials: * gaskets are stripes of various fully cured electrometric (rubber like) materials.
✓ Preformed cellular tap sealant: is a polyurethane sponge material that has been impregnated with a mastic sealant.
✓ Preformed solid tap sealant: a sealant inserted in to the joint in the form of flexible strip of solid materials. Are used only in lap joints as in the mounts of glass in a metal frame or the over lapping of two thin of metal at a cladding seam. Slant Gunn a tool for injection in to joint.

4.2.4 Casting techniques

- **Concrete supply**: disturb ion, placement, & compaction methods employed in pre-cast production are quite d/c from those in situ construction. Very safely & more highly mechanize techniques are employed. Concrete batching in central plant has to be distribution at a high rate. The demand can be much as $2m^3$/min though-out the working shift & this can only be achieved using automated bathing & mixing equipment & distribution concrete by "bullet" or monorails ,skips discharging to receiving hoppers or machines.
- **Static machines**: this is same elements & repetitive out puts RCC elements & up to 4.5 tones mass can be produced by dedicated machines. The concrete will be supplied from a computer – controlled batching & mixing plant matched to the though out of elements.
- **Mobile casting machines**: in this producing sleepers & linear products such as a pile on the long line bed. Use in made of mobiles casting machines.
- **Casting in individual molds**: such as frame components & cladding panels as well as bridge parapet units are in individual molds. Production is of the nature of jobbing production where teams each specialized in one part of the process work. On each of a no of molds turn, carry out assembly, steel fixing, finishing & sub sequent striping, clearing & oil molding.
- **Tilting table**: same of static but the gang casting molds provides on economic

solution therefore where the large no of similar elements of simple section such as piles or rectangular section beam, columns, are to be cast. Within gang mold elements are set by side to side or end to end .with mold divider generating the section. This technique are frequently employed on long & short line pre-stressed beds, beams, lintels, & sleepers, production provides examples of a gang casting.

- **Battery & cell unit**: the same of with gang casting although used for d/c sections of elements. well elements are cast side by in mold assembles comprise a series of dividers suspended in rialto form cells or molds batteries may comprised 20 to more cells & continuous batteries may comprised 100or more cells.

Materials used for battery molds construction are heavy steel plate dividers or lighters plate mounted on steel framing.

4.2.5 General notes

- Pre-cast solid slab floor: a concrete slab without ribs or voids that span b/n beam or bearing wall
- Pre-cast hollow core slab: that has internal longitudinal cavities to reduce its weight
- Single tee: a pre-cast slab element whose profile resembled the letter T
- Double tee: a pre-cast slab element that resembled the letter TT in cross section
  - ✓ Mold designed is very important in pre-cast concrete unit.
  - ✓ Erection at site is generally carried out by small teams of specialist
  - ✓ During the connection of slabs (floor unit) the range of connection employed to satisfy these requirements included welded, bolted, cast etc.
  - ✓ In cladding the norm for reinforced concrete cladding appears to be span drill panels of the order 6m -9m a cladding panels up to 6m long one or two story high with a masses about 20tones
  - ✓ Each mold will be designed to cast asset or part of set elements.
  - ✓ Where are (runs) of 30-50 & 100 elements are produced in permanent forms called bed casting.
  - ✓ Casting bed average 125m up to the extend 250m or more in some plants

Self-Check -4	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Which one is not the primary function of cladding?

A. Controlling the radiation of heat

B. Controlling sound

C. Resister fire

D. Preventing air leakage

2. Which one of the following are correct statements of precast cladding unit?

A. Is a material used as the exterior wall including of building

B. Controlling light

C. Keep water out

D. All

3. ————————is aiding and accelerating reaction of concrete by the application of steam

A. Curing method

B. Casting of concrete

C. Finishing of concrete

D. All

4. Limitation of precast concrete unit

A. Extra reinforcement is required to take care handling

B. Temporary props may not required

C. Precast element may have not smooth

D. None

5. Which one is not advantage of precast

A. Joint may be problem

B. Very safe at uncomfortable condition during construction

C. To save time

D. There is better quality control

Note: **Satisfactory rating - 5 points** **Unsatisfactory - below 5 points**

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date: _____

Short Answer Questions

Operation Sheet 1	Interpreting information/drawings

Techniques for interpreting information/drawings:

Step 1- familiarize yourself with scale of the drawings

Step 2- understand the basic symbols

Step 3- look for circled numbers

Step 4- identify specific abbreviations

Step 5- work with colleagues

.

Operation Sheet 2	Selecting materials, components, tools and equipment

Techniques for Selecting materials, components, tools and equipment

Step 1- wear PPE

Step 2- select appropriate materials, components, tools and equipment

Step 3- set in order by placing the tools and equipment's in proper places

Step 4- clean each tools and equipment.

Operation Sheet-3	Preparing form and erecting pre-cast concrete structural units and cladding components

Procedures for preparing form and erecting pre-cast concrete structural units and cladding components

Step 1- wear PPE.

Step 2- select required pre-cast concrete structural units and cladding units

Step 3- prepare form pre-cast concrete structural units and cladding units

LAP Test	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within --- hour.

Task 1. Interpret information/drawings

Task 2. Select materials, components, tools and equipment

Task 3. Prepare form and erecting pre-cast concrete structural units and cladding components

Reference

- Different website like the contractor civil engineering .com
- Internet
- Christian Meuli Karl Wehrle Heini Müller Heini Pfiffner Volume 3

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