NSCET
E-LEARNING PRESENTATION

LISTEN ... LEARN... LEAD...
IVth YEAR / VIIIth SEMESTER

CE 6016 – PREFABRICATED STRUCTURES

R.Vijayalakshmi, M.E., MISTE.,
Assistant Professor
Nadar Saraswathi College of Engineering & Technology,
Vadapudupatti, Annanji (po), Theni – 625531.
OBJECTIVES:

• To impart knowledge to students on modular construction, industrialised construction and design of prefabricated elements and construction methods.
UNIT I INTRODUCTION

- Need for prefabrication
- Principles
- Materials
- Modular Coordination
- Standardization
- Systems
- Production
- Transportation
- Erection
UNIT II  PREFabricated Components

- Behaviour of structural components
- Large panel constructions
- Construction of roof and floor slabs
- Wall panels
- Columns
- Shear walls
UNIT III DESIGN PRINCIPLES

- Disuniting of structures
- Design of cross section based on efficiency of material used
- Problems in design because of joint flexibility
- Allowance for joint deformation.
UNIT IV JOINT IN STRUCTURAL MEMBERS

- Joints for different structural connections
- Dimensions and detailing
- Design of expansion joints
UNIT V DESIGN FOR ABNORMAL LOADS

- Progressive collapse
- Code provisions
- Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc., -
- Importance of avoidance of progressive collapse.
TEXT BOOKS:
1. CBRI, Building materials and components, India, 1990

REFERENCES:
This Presentation

- Definition
- Need for Prefabrication
- Advantages & Disadvantages
- Limitations
- Uses
- Principles of Prefabrication
- Methods of Prefabrication
- Classification
- Standardization
- Production system
- Prefabrication process
- Manufacturing
- Stacking
- Handling
- Transporting
- Erection
- Machines for hoisting

Syllabus

- Need for prefabrication
- Principles
- Materials
- Modular Coordination
- Standardization
- Systems
- Production
- Transportation
- Erection

Unit I - Introduction
Prefab.
Need for Prefabrication

✓ Speedy Construction - No curing period
✓ Effect Economy
✓ Improve quality
✓ Durable structure with less maintenance
✓ Aesthetic finish
✓ Further expansions easy
Advantages

- Self supporting Readymade does components – not need formwork, scaffolding, and
- Construction time is reduced.
- Quality control is easy.
- Time exposed in Bad weather and hazardous is minimized.
- Less wastage -or wastage / scrap can be recycled
- On site congestion can be minimized
- Moulds can be reused.
Disadvantages

✓ Very Skilled crew
✓ Careful handling of components
✓ Leakages at joints
✓ Heavy duty cranes and precision measurement to place in position
✓ Very costly when the factory is very far away from the site.
Limitations of Prefabrication

- Very Costly
- Uneconomical for smaller projects
- Transportation difficulties
- Safety of Crane and other support system has to carefully considered.
- Difficulties in transportation of vary large components
- Waterproofing joints
Uses

The following are the uses of introducing the prefabrication system:

- Prefabricated components speed up construction time, resulting in lower labor costs;
- Prefabrication allows for year-round construction;
- Work is not affected by weather delays (related to excessive cold, heat, rain, snow, etc.);
- The mechanization used in prefabricated construction ensures precise conformity to building code standards and greater quality assurance;
- There are less wasted materials than in site-built construction;
- There is less theft of material/equipment (and less property damage due to vandalism);
- Materials are protected from exposure to the elements during construction;
- Worker safety and comfort level are higher than in site-built construction;
- Computerization of the production process permits a high degree of customization, at an affordable cost;
- Quality control and factory sealing and design can ensure high energy efficiency; and
- Cost savings through prefabrication can reduce the income required to qualify for a high ratio mortgage by up to one third compared to a conventionally built home of the same size.
Prefabrication principles

➢ To give safety in structural system
➢ To design the building as an aesthetic one
➢ To effect economy in cost
➢ To improve in quality as the components can be manufactured under controlled conditions.
➢ To speed up construction since no curing is necessary.
➢ To use locally available materials with required characteristics.
➢ To use the materials which possess their innate characteristics like light weight, easy workability, thermal insulation and combustibility etc.
Two methods of prefabrication

- Plant prefabrication
- Site prefabrication
Classification of prefabrication

- Small prefabrication
- Medium prefabrication
- Large prefabrication
- Partial prefabrication
- Open system prefabrication
- Closed system prefabrication
- Total prefabrication
- Cast-in-site prefabrication
- Off-site prefabrication
Standardization is the repeated production of standard sizes and or layouts of components or structures which may occur on site or off site.

Example
Modular Bathroom, Standard kitchen cabinet, prison cell etc.
Advantages of standardizing prefabricated components are under:

✓ Easier in design as it eliminates unwanted choices
✓ Easier in manufacture as there are limited number of variants.
✓ Makes repeated use of specialized equipment in erection and compilation easier and quicker.
Factors influencing Standardization

• To select the most rational type of member for each element form point of production, assembly, serviceability and economy.
• To limit the no. of types of elements.
• To use large size of elements so as to reduce no. of joints.
• To limit size so as to manage overall weight to handle the component during its stacking transportation and erection.
Prefabricated systems

Major systems are:

• Large panel system
  - Longitudinal wall system
  - Cross wall system
  - Combined system.

• Structural Frame system

• Lift panel system (Column slab system)

• Mixed system.

It can also be categorized as

• Open prefabricate system
• Closed prefabricate system
Production systems

Line up System (conveyor belt system)

Aggregate system
Prefabricated Structures - Process

1. Manufacturing process (on the production site)
2. Stacking the components before shipping
3. Transportation (to the construction site)
4. Erection (on the construction site)
Manufacturing process
Machineries used for handling

- Skids
- Gantry girder
- Fork lifts
- Mobile crane
Stacking during transport and storing the components

Precautions to be taken while Storing the Components
Stacking – Dos and Don’ts

• Stacking method and packers for support spacers vary according to the type of precast elements.
• Horizontal stacking – beams, slabs and columns
• The storage support position for beams and slabs – within 300 mm from the lifting points
Stacking – Dos and Don’t s

Do not use more than two support points in particular pack for prestress elements like hollow core slab
Stacking – Dos and Don’ts

The packers or support spacers should not be misaligned as shown
Wall panels should always be stored vertically and braced in position by A-frames or racking systems.
Different storage and stacking examples

Façade Wall Panels

Precast Beams and Columns
Precautions during transport

- Use of polythene wrapping as a form of protection against stain and damages.
- Use of styrofoam to minimise damages to precast elements at support end.
- Cushion packing should be provided to prevent damage to the edges of precast elements.
- Use of timber packer to secure the precast elements.
- Protection of the critical connection details such as the threaded parts of bolt connection against rust and thread loss.
Erection and Installation of components on site: Requires proper attention and skill to prevent the elements from developing erection and handling stresses
Temporary strengthening of panels with opening is necessary
The lifting points should be designed and located to limit the bending moments within the beam element.

As a general guide, they should be located at about one fifth of the beam length measured from the edge.
Precast Wall

For wall panels, it is recommended to lift the panel in vertical position for installation so that turning is not required.

Hoisting method adopted for demoulding of wall panels that are cast horizontally.
Wherever necessary multiple lifting points can be designed and located to minimize undue stresses within the slab elements, in particular for slender panels such as precast planks.
Columns are usually first handled in horizontal position. Slings are attached to the inserts at the top to facilitate the rotation of the elements to vertical position before hoisting and placing to their designated location.
A derrick is a lifting device composed at minimum of one guyed mast, as in a gin pole, which may be articulated over a load by adjusting its guys. Most derricks have at least two components, either a guyed mast or self-supporting tower, and a boom hinged at its base to provide articulation.

The most basic type of derrick is controlled by three or four lines connected to the top of the mast, which allow it both to move laterally and up and down. To lift a load, a separate line runs up and over the mast with a hook on its free end, as with a crane.