



# CONSTRUCTION OF PREFABRICATED BUILDING COMPONENTS USING FLY ASH

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## Abstract

*In today's world, where speed and convenience play a big part in influencing the use of any product, the age of prefabricated housing products seems to have finally arrived. The usefulness of these products help significantly in speeding up construction by offering ready-to-install building elements such as blocks, joist beams, roof blocks and panels is being widely recognised in the industry. Pre-fabricated components are becoming immensely popular due to the several attractive advantages that they offer, such as off-site fabrication, which allows reduction in construction time and this function helps greatly in managing the schedule of the construction project. Due to their low density, the prefabricated components impose a relatively lighter load on the structure and superior quality can also be achieved as these components are manufactured*

*under a strictly controlled environment. In recent times few innovations in the field of materials are expected to make these products even more popular, user friendly and eco friendly. The present paper discusses on the manufacturing of prefabricated building components using fly ash, and explains regarding fabrication, centring, placing, applications and the advantages over the monolithic construction.*

*This paper aims to popularize the promotion of prefabrication building methodologies for low cost housing by highlighting the different prefabrication components and techniques, and the economical advantages achieved by its adoption.*

## Introduction

### Prefabrication:

“Prefabrication” is the manufacture of an entire building or components cast in a factory or on site before being placed in position, assembling the structural units so that they can be easily and rapidly erected. Prefabricated buildings are pre-cut, pre-drilled, and pre-engineered before the actual building is constructed. Prefabricated Structures (PFS) are useful for sites, which are not suitable for normal construction methods such as hilly regions, and also when normal construction materials are not easily available. Structures which are used repeatedly and can be standardized such as mass housing, storage sheds, godowns, shelters, bus stands, security cabins, site offices,



foot over bridges, road bridges, concrete building blocks etc., are prefabricated structures. This paper discussing about the mix proportions of the materials to manufacture the prefab components and the construction procedure for an ordinary single story residential building.

### **Criteria for selection of prefab in India:**

In India, the technology adopted for housing components should be of the order that, the production and erection technology be adjusted to suit the level of skills and handling Facilities available under metropolitan, urban and rural conditions. In other words, the structural systems and components selected should ensure minimum material Utilization with maximum structural advantage. However, the component and systems so designed are to be manufactured and erected by manual means in villages, semi mechanical techniques in towns and more or less fully mechanical operations in the metropolitan cities. In urban areas, the concentration of construction activity does not justify prefabrication. A wide variety of roofing methods to suit these requirements have been developed and used on mass scale in many housing projects such as funicular shell, cored slabs, RCC channel units, precast cellular units, precast RC planks and joists, prefab brick panels and joists, RCC joists and hollow concrete blocks.

### **Material used for Prefabrication:**

Prefabricated components can be manufactured using many materials, depends up on the type of structure. Generally materials used are Wood,

Steel, concrete, plastic and composite materials .If the structure is wooden house then prefabricated wooden panels, columns, posts are used. If the structure is prefabricated steel truss bridge then steel members like angles, I, L-sections and rives, bolts are used. If the structure is houses in developed countries then the prefabricated plastic internal partition walls, doors, panels and toilets are used. The man made rock concrete is also widely used for the manufacturing of the prefabricated members. Instead of using complete cement concrete we are replacing the some quantity of cement with an industrial waste product like flyash. Because of adding the flyash we can get many benefits for the environment as well as prefabricated structure. Before going for the advantages of it, first know the properties of the flyash.

### **Fly Ash:**

Fly Ash is a by-product of a thermal power station, after combustion of coal and production of power. Fly Ash is generated from coal fired generation units. Coal has a dominating role for the power generation in India. Presently there are 70 coal based thermal power plants operating in India. Most of the thermal power plants in India use inferior quality coal, having low calorific value which after combustion, leaves behinds a larger per cent of ash. As the power required in industrial and agricultural sectors increase, production of ash increases. Fly ash contains many toxic elements. Abundant quantities of fly ash are being produced by thermal power plants situated all over the world. At present 100 MT of coal ash is produced annually in India. Fly ash is a complex material and its characterization is quite difficult. It is observed that the overall chemical composition varies from particle to particle and from one sample another. Even initial pulverization of the coal and efficiency of firing have significant influence on the grading of the fly ash produced. It appears that difference in particle size distribution; morphology and surface characteristics of fly ash would influence water demand and reactivity. The principal constituents of fly ash are silica (SiO<sub>2</sub>), Alumina (Al<sub>2</sub>O<sub>3</sub>), Iron oxide (Fe<sub>2</sub>O<sub>3</sub>), Calcium oxide (CaO), small



amounts of magnesium, sulphur, and unburned carbon Let us know the properties of the Fly Ash.

## Methodology

For case study we consider, single storied residential building consists of 4- rooms constructed with prefab components and compared with monolithic construction.

*Steps for construction using prefabricated components:*

1. The *foundation* is constructed as usual monolithic construction procedure; here also we can use fly ash blocks for supporting walls.
2. For construction of *columns* a specially made *column blocks* are available which is having central gaps, which are useful for placing of the reinforcement.
3. All the load bearing and internal *walls* are constructed with *solid fly ash bricks* and hollow bricks.
4. The corners joints can be constructed using *inter locking wall bricks*.
5. After completion of the room height *beam blocks* are laid over the walls, which are acted as a beams for the building.
6. Roof is constructed as explained in roof blocks and joist beams.
7. After placing all the roof blocks and joist beams, a 6mm wire mesh is laid over the entire roof then lean mix of cement mortar is laid over it and the total thickness of the roof should be restricted to 4 inches only.
8. Being long spans of joist beams are available we can lay the roof for all the rooms at a time so that economically we can save the manpower.
9. After hardening of 3 days curing is to be done for two days. Then the finishing of walls and floors are to be done. Since the bricks used are fly ash, the plastering cement can be minimized.

Then the construction is compared with monolithic construction, So by using prefab comp., we can save the materials up to 40%. Come for cost of construction is about 25-

- 30% we can save.
- We can get more strength with less weight. We can
- control the temperature variations. We can save 15% of
- labour cost
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## CONCLUSIONS

Mass housing targets can be achieved by replacing the conventional methods of planning and executing building operation based on special and individual needs and accepting common denominator based on surveys, population needs and rational use of materials and resources. No single approach and solution is available which can satisfy the community at large. However, what is ideal and desirable is to have a system, which can provide choice for people and also appropriate techniques to meet the situation. The essence lies in the system approach in building methodology and not necessarily particular construction type or design. Adoption of any alternative technology on large scale needs a guaranteed market to



function and this cannot be established unless the product is effective and economical. Partial prefabrication is an approach towards the above operation under controlled conditions. The methodology for low cost housing has to be of intermediate type less sophisticated involving less capital investment. The Govt. of India has to popularize these components and the implement them at least for low cost Govt. houses. People should be more aware about these products and save the environment by using the thermal waste in a better manner.

**“Use the Thermal Waste in proper way and gets the Economical Construction”**

## References

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