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COMPARATIVE STUDY ON MODULAR CONSTRUCTION WITH IN-SITU CONSTRUCTION OF RESIDENTIAL BUILDINGS

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ABSTRACT

The main objective of the work is to study the present situation of modular construction and study the cost effectiveness of construction modular building for residential purposes. A literature survey was carried out in other to obtain the cost comparisons between modular structure and cast in place (in-site) structure. After careful study of the bill of quantities of the two construction methods, the result shows that modular construction cost is higher than, that of the In-situ construction for one storey building.

KEYWORDS: Modular construction, in-situ construction, cost, residential building.

INTRODUCTION

Construction industries in the world is gaining ground and growing in a very rapid ways, both in developed, developing and under developed countries, which provide great opportunity to various field of specialization in the construction industry. Technology and innovation play a vital rule by making architectures and engineers to shape up the construction industry with new techniques of erecting structures to suite with the environment and it purpose. At present modular structures are the latest technique adopted in the world. Modular structures or construction are consider as volumetric components of building that are manufactured in a factory under special care, and transported to the site on a flatbed trailer, and assembled at a required site as a finished building. Modular buildings are becoming popular for many constructions because they can be built in many different shape and sizes for different purposes. Modular building appears as good as on-site constructed structures.

ADVANTAGES OF MODULAR CONSTRUCTIONS

Modular construction has the following advantages;

1. Its improved the safety of construction

The mode of safety in modular is develop in a specific safety terms, such as;

a) Working in a control environment
b) Working at ground level.

Modular structures provide safety in the construction industry because, majority of the assemble work is done in the factory, where the environment is controlled and condusive to safer practice. Achieving safety is easier in the factory than on-site where bad weather, lack of skilled labor or lack of require space, and uncertainties may exist.

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Picture of safe manufacturing factory

Increased possibility of construction
It provides the ability to carry out construction at remote location and can be used to overcome hostile environment. Construction works in remote location that are not feasible using conventional construction are often feasible using modular.

Seismic properties
Modular structures have excellent robustness, which means that, they can meet seismic standard.

Re-locatability.
Modular structures can be disassembled and create new building.

Picture of modular structure ready for transport

5. Short built up time

Modular structure require less time than conventional on-site construction.

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6. Quality

Modular structure achieved it quality because of

a. Proper module testing
b. Good quality control
c. Availability of skilled forces
d. Better working environment

Picture of Quality checkup

LITERATURE REVIEW

Among the earliest example of modular construction is the construction of Britain exhibition center in 1851, when crystal palace was constructed in a few months and assembled in a series of prefabricated parts. The exhibition was also then taken apart after the event and reassembled at another site. This is the precursor to modular or factory-based fabrication of buildings. In the 1900s the United States entered the market when the Sears Roebuck Company so prefabricated homes via mail order. [1]

In contrast to the startling growth and technical advances witnessed this century in many industries, progress in the building industry, particularly the improvement in productivity and technology, has generally been relatively slow. An exception has been the emergence and growth of modular building method. The idea of factory made housing was developed in the late 1920s and 1930s in Germany through architect such as Peter Behrens and Walter Gropius and in USA through Richard and Buckminster Fuller. Mass production of motor cars led to similar concept of housing, starting firstly with panel or component based systems and later extended to volumetric unit. [2]

The TATA housing group is working on a housing project based on innovative prefabricated technologies. These houses will cost as low as INR 32,000. Tata Group will provide a kit consisting of structural elements which can be erected or assembled. These houses have an area of 20-30 sq mtrs and lifespan of 20 years. The project is still in pilot stage and will soon be implemented across the country. [3]

METHODOLOGY

The method adopted for this study of comparism between modular construction and cast in place (In-situ) construction. A residential building is considered as a case study which includes the plan preparation, bill of quantity of cast in-situ construction and data obtained from modular companies.

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PLAN PREPARATION

The plan used for this study is a one storey building which will helped to estimate the quantities of the needed materials for modular and cast in-situ construction. The plan of the building is shown in fig.

BILL OF QUANTITIES

Bill of quantities or estimation of quantity is used in order to determine the required detail quantities of the materials needed for the construction as per obtain from companies. The estimation of quantities for the one storey residential building is presented in table

COST ANALYSIS

As per this study, this is the main area of consideration because it gives out the details of comparism of the cost analysis of the one storey residential building for modular construction and in-situ construction. Machineries, materials and labor resources are considered in this analysis.

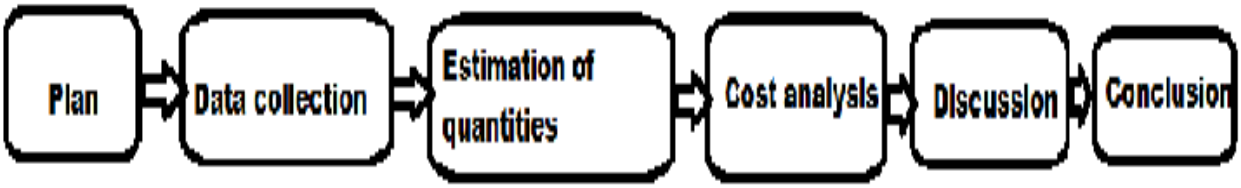
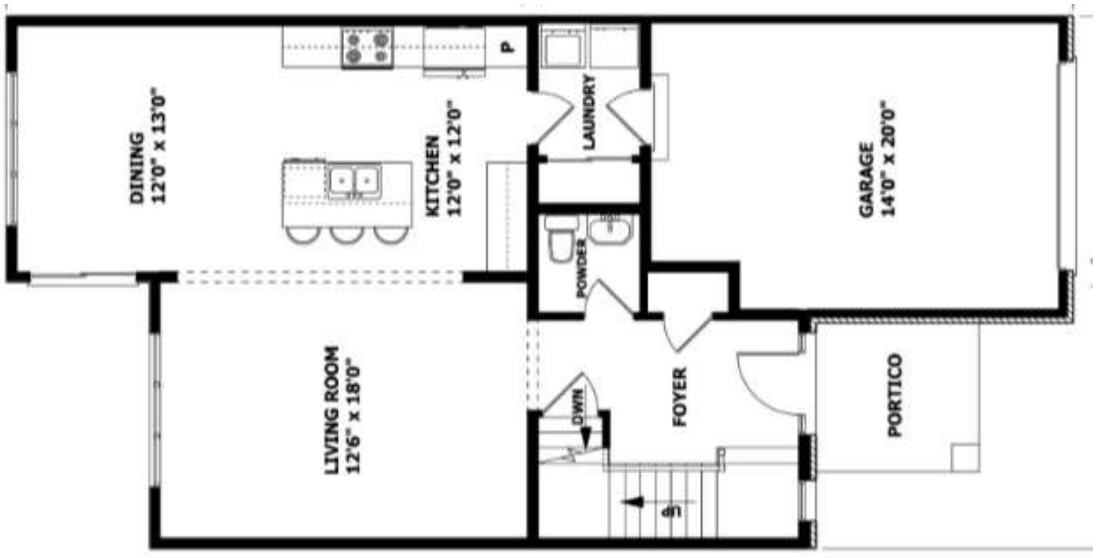


Fig. 3.1 Work Methodology flow chart



Ground floor

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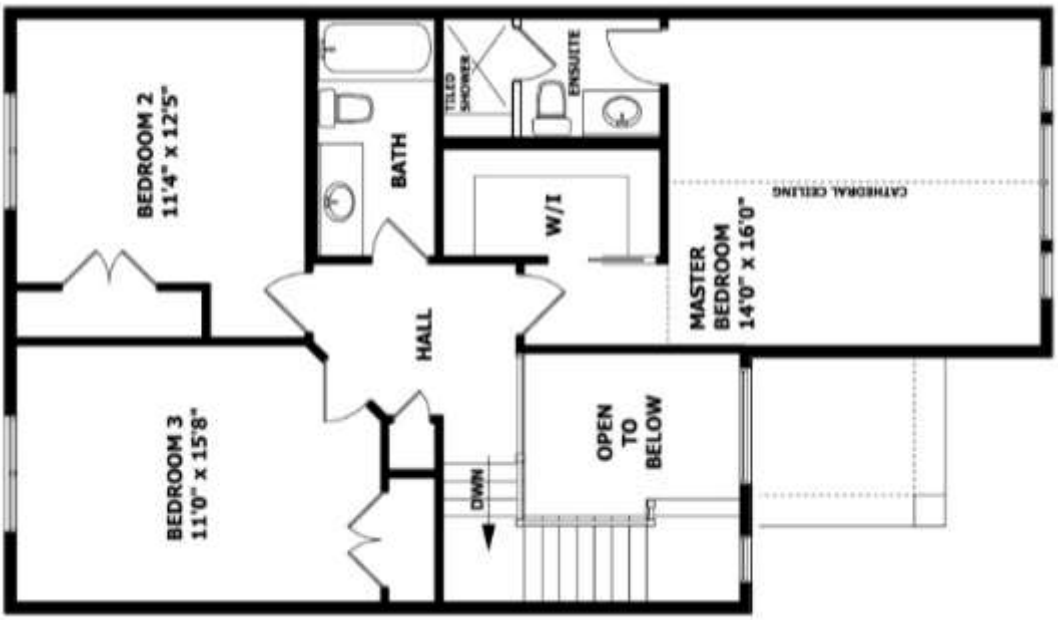

Fig. 3.2 First floor

RESULT AND DISCUSSION

S/n	Description	Amount
1	Sub-structure	535000.00
2	Super structure	13211.80
3	Finishing	7500.56
	TOTAL	55,5712.36

Fig. 4.1 cost of construction modular

The cost of modular construction was obtained from modular company, which helps to determine the cost of super structure and the finishing work. The sub-structure work cost is the same as cast in place (in-situ) construction. The reason is that, the same process is employed in modular construction. The total amount of constructing one storey building stands as fifty five lakh five thousand seven hundred and twelve point three ,six rupees only. (IRP 55, 5712.36). as in Fig. 4.1

S/n	Description	Amount
1	Sub-structure	535000.00
2	Super structure	113400.00
3	Finishing	456600.00
	TOTAL	52,1440.00

Fig. 4.2 cost of cast in place (in-situ)

The cost of in-situ construction was also obtained from construction company, which helps to determine the over roll cost of the construction work from sub-structure, super structure and the finishing. The sub-structure cost is taken to modular construction as per same process is followed in the construction work. But a change is notice at, super structure and finishing cost of cast in place (in-situ) construction work. The total amount of constructing one storey building stands as fifty two lakh fourteen thousand four hundred rupees only. (IRP 52, 14400.00). as in Fig. 4.2

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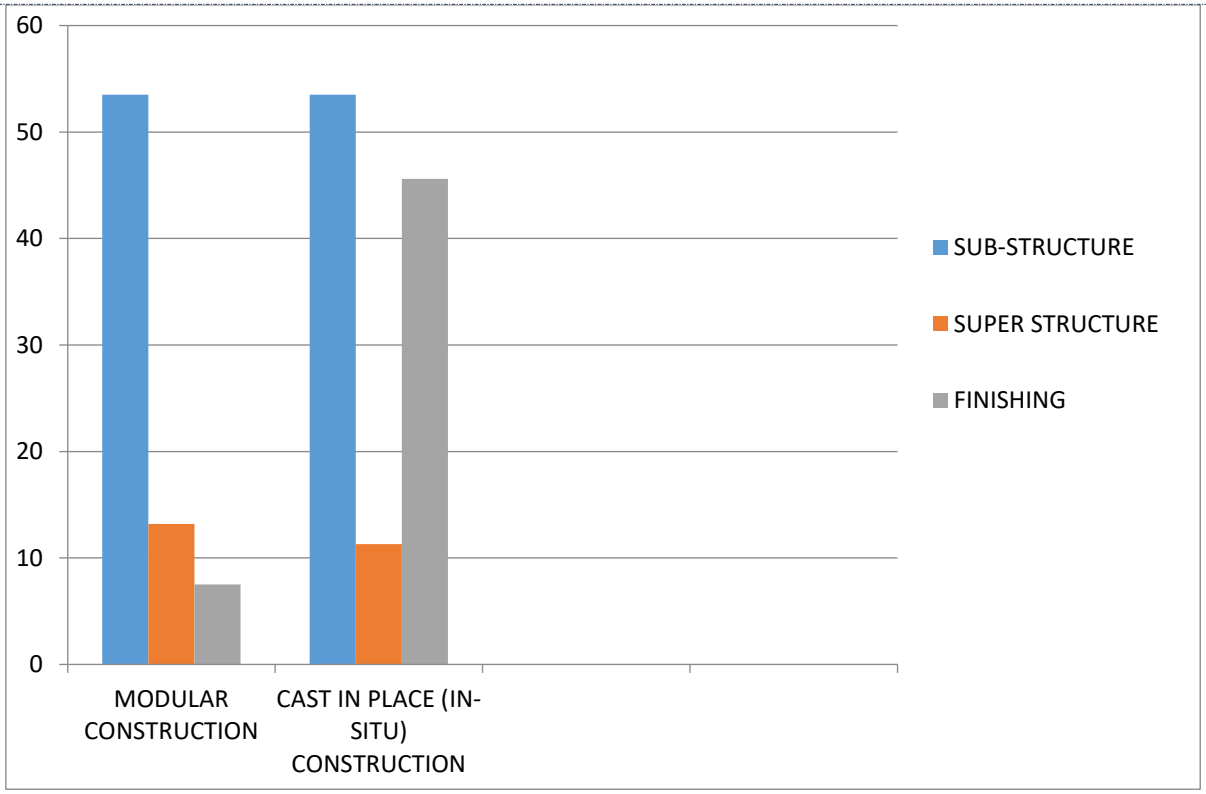

Fig. 4.3 cost comparism of the three stages of construction

The result of the analysis we have, has showed to us the cost of constructing both modular and in-situ residential building, in three different stages of construction. In case of modular construction, much of the finishing are incorporated in the super structure because almost all are installed in the factory, which is why there is variation in the cost for the final finishing, as showed in Fig. 4.1 for modular construction and Fig. 4.2 for in-situ construction.

CONCLUSION

The aim of this work is achieved, since the cost of constructing one storey building for residential use has been determined for both modular structure and cast in place (in-situ) structure. Also it has come to our notice, the difference in the cost of constructing a one storey residential building using the two methods. In modular construction the cost is higher than the In-situ construction.

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