Optimization of Construction Cost In Residential Building

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Abstract- *in this project we are presenting the details about low cost construction of a residential building. Cost optimization aims to cut down the construction cost by using alternatives to the conventional methods. The estimation of 1330 sq.feet residential building is made about Rs. 30, 75,000. In this building, we have implementing the new construction techniques and materials to achieve the cost optimization. The various techniques and materials adopted in this project are filler slab technique, ferrocement door, terracotta hollow block and manufactured sand to attain the economy in construction. This methodology brings down the total cost of building by lowering the cost in both materials and labor aspects. It is necessary to achieve the cost optimization of the building without sacrificing the strength at any situation. It should be noted that low cost housings are not houses which constructed by cheap building materials but it is using the substandard quality material. High efficiency of workers, minimize waste in design and good management practices can also paved the way for cost optimization. Suggestion for reducing construction cost in this paper is of general nature and it varies depending upon the nature of the building to be constructed and budget of the building.*

Keywords- filler slab technique, ferrocement door, terracotta hollow block, manufactured sand.

I. INTRODUCTION

The cost optimization is a process that should be carried out throughout the construction period to ensure that the cost of the building is kept within the estimated cost limits. Cost optimization of a project involves the collecting and measuring the cost record of a project and the work progress. It also includes the comparison of actual progress of project cost with the estimated. Many of challenges has to be faced by the construction industries which includes design and constructability issues, time and cost related issues, rising material and labor costs, structural changes. The cost optimization can divide into two major areas; the optimization of cost during design stages and the optimizing the cost by the contractors once the construction ofproject has started.

Cost optimization of a project involves collecting and measuring the cost record of a project and the work progress. It also includes the comparison of actual progress of project cost with the estimated. The main objective of cost optimization of a project is to gain the maximum profit within the design period and with satisfactory quality of work. It is necessary to decide which optimization is required and amount of detail that will be in used into the construction stage. The cost itself is a major difficulty in operating a detailed cost optimization system. It is an expensive operation for a large contract to carry out a detailed cost optimization system.

- **Filler Slab Technique**

Filler slab technology is a simple and very innovative technology for a slab construction. Concrete is good in taking compression and steel is good in tension. Thus RCC slab is a product which resists both compressions as well as tensile. Filler slab is a very cost effective roofing technology. It is not easy to remove, the concrete from the tension zone, hence concrete can be replace (partially) that part of concrete using light weight and low cost filler material. This method of construction is called filler slab. Filler slab technology is being used across India, but substantial amount of work on the successful promotion and mostly adopted in South India.

- **Manufactured Sand**

River sand is a widely used construction material all over the world, especially in the production of concrete, cement-sand mortar and concrete blocks. Various Government, Non-Governmental Organizations and Research Institutes are striving to identify alternative materials to supplement river sand. There is a strong need for research on river sand substitutes for concrete production and cement sand mortar production. Manufactured sand is popularly known by several names such as Crushed sand, Rock sand, Green sand, UltraMod Sand, Robo sand, Poabs sand, Barmac sand, Pozzolana sand etc. IS 383-1970 (Reaffirmed 2007) recognizes manufacture sand as “Crushed Stone Sand”.

Fine aggregates manufactured sand proposed to be used shall be produced from a Vertical Shaft Impact (VSI) crushers and shall conform to the requirements as per IS 383-1970 (Reaffirmed in 2007) and particles finer than 75 µm shall not exceed 15 %. Special efforts on the part of M-sand manufacturers (such as washing of sand by water or dry washing by air) is required to restrict particles finer than 75 µm to 15%. The global trend is to utilize dry classification solutions to produce manufactured sand. The dry separation process separates fine and coarse particles. This allows a reduced percentage of super fines in manufactured sand, thereby meeting specifications and achieving quality products.

- **FERROCEMENT DOOR**

Ferrocement is a versatile structural construction material possessing unique properties of strength and serviceability. It is made with closely-knit wire mesh and mild steel reinforcing bars filled with rich cement mortar. Welded mesh may also be used in place of reinforcing bars. The materials required for making it, namely, cement, sand, wire mesh, and mild steel reinforcing bars, are easily available in most places. It is possible to fabricate in ferrocement a variety of structural elements which are thin, light, and durable and possessing a high degree of impermeability. Ferro cement combines the lightness of steel and mouldability of concrete and can be cast to any shape.

- **TERRACOTTA HOLLOW BLOCKS**

Terracotta Hollow Blocks are one of the best Natural Construction Material for the construction of Cost-Effective Buildings If we are using Terracotta Hollow Blocks the Cement Consumption can be reduced for construction of wall. External and Internal Plastering is not required for this wall. So again Cement consumption will come down. Instead of painting we can use one coat of clear Varnish only on the External wall surface. Heat will be less inside the building because of the Air Pockets in Wall. Foundation, Pillar and slab will be like any other Concrete Framed Structure. For brick work we need 65kg cement for one Cum of brick work. But for this Terracotta Hollow blocks only 11kg to 18kg Cement is sufficient for One Cum of Wall construction.

II. LITERATURE REVIEW

M.G. Sahab et al (2004) has investigated Cost optimisation of reinforced concrete flat slab buildings according to the British Code of Practice (BS8110) is presented. The objective function is the total cost of the building including the cost of floors, columns and foundations. The cost of each structural element covers that of material and labour for reinforcement, concrete and formwork. The structure is modelled and analysed using the equivalent frame method. The optimisation process is handled in three different levels. In the first level, the optimum column layout is achieved by an exhaustive search. In the second level, using a hybrid optimisation algorithm, the optimum dimensions of columns and slab thickness for each column layout are found. In this hybrid algorithm, a genetic algorithm is used for a global search, followed by a discretised form of the Hook and Jeeves method. In the third level, an exhaustive search is employed to determine the optimum number and size of reinforcing bars of reinforced concrete members. Cost optimisation for three reinforced concrete flat slab buildings is illustrated and the results of the optimum and conventional design procedures are compared.

Sara A. Babiker et al (2012) have examined an Artificial Neural Networks (ANN) model for the cost optimization of simply supported beams designed according to the requirements of the ACI 318-08 code. The model formulation includes the cost of concrete, the cost of reinforcement and the cost of formwork. A simply supported beam was designed adopting variable cross sections, in order to demonstrate the model capabilities in optimizing the beam design. Computer models have been developed for the structural design optimization of reinforced concrete simple beams using NEURO SHELL-2 software. The results obtained were compared with the results obtained by using the classical optimization model, developed in the well-known Excel software spreadsheet which uses the generalized reduced gradient (GRG). The results obtained using the two modes are in good agreement.

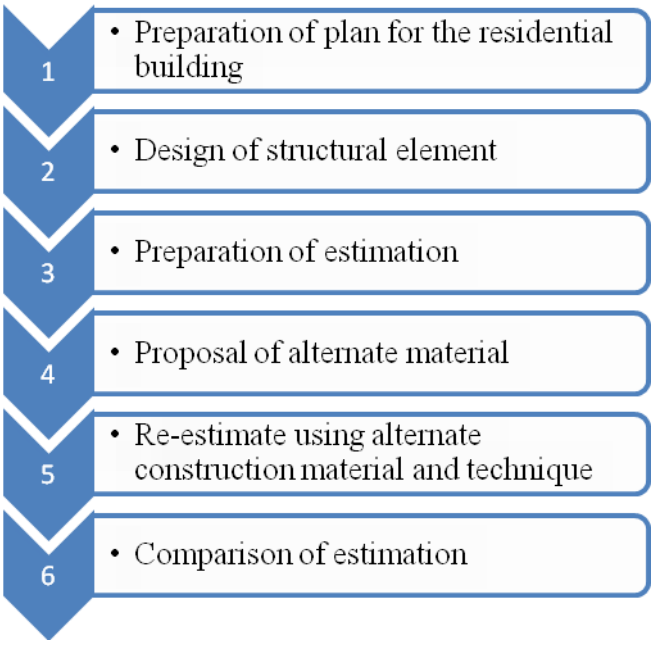
Kamal C. Sarma (1998) has studied Construction of concrete structures involves at least three different materials: concrete, steel, and formwork. As such, design of these structures should be based on cost rather than weight minimization. A review of papers on cost optimization of concrete structures published in archival journals is presented in this paper. These structures include beams, slabs, columns, frame structures, bridges, water tanks, folded plates, shear walls, pipes, and tensile members. Interesting and important results and conclusions are summarized. A review of reliability-based cost optimization is also included in the paper. It is concluded that there is a need to perform research on cost optimization of realistic three-dimensional structures, especially large structures with hundreds of members where optimization can result in substantial savings. The results of such research efforts will be of great value to practicing engineers. Additional research needs to be done on life-cycle cost optimization of structures where the life-cycle cost of the

structure over its lifetime is minimized instead of its initial cost of construction only.

Seyed Ali Mousavi Dehmourdi (2014) has evaluated different accidental and intentional events like terrorist attacks related to important structures all over the world; explosive loads have received considerable attention in recent years. The design and construction of bridge to provide life safety in the face is receiving renewed attention from structural engineers. Analysis of highway bridges under blast loads requires accurate generation and application of blast loads and good understanding of the behavior of components of bridge. The purpose of this paper is to introduce some ideas about blast load generation method like pressure wave method, detonation simulation method, hybrid blast load method and multi-Euler domain method. Also verification of blast load results using hybrid blast load method and multi-Euler domain method included in this paper.

Pathak.U.J, et al (2014) Low cost housing technologies aim to reduction in construction cost using alternatives to conventional methods. Authors examined the cost effectiveness using low cost housing technologies comparing with the traditional construction methods. From Two case studies in India found that about 22 to 26 % of the construction cost can be saved by using the low cost housing technologies including labor and material cost comparing it with traditional construction methods for walling and roofing respectively.

III. METHODOLOGY



IV. DETAILS OF THE BUILDING

Plinth area = 1330 sq.ft
Floor = G+1
Floor height = 3m
Building type = residential
Height of the building = 7.3 m (above plinth)
Rooms in ground floor = 10
Rooms in first floor = 6
Total cost of estimate = Rs.30,75,000.00
Grade of concrete = M25
Grade of steel= Fe 500

V. EXPERIMENTAL RESULTS

S.No	PARTICULARS	ACTUAL ESTIMATE	REVSED ESTIMATE	SAVINGS
1	PCC	44,000	31,000	13,000
2	Brickwork	9,60,000	5,80,000	3,80,000
3	RCC	4,70,500	3,54,500	1,16,000
4	Plastering	1,75,000	0	1,75,000
5	Doors & windows	2,25,000	1,25,000	95,000

VI. CONCLUSION

The total estimated cost of the building by using conventional method of construction is Rs. 30, 75,000. Some of the alternate material and construction techniques are used to achieve optimization of the residential building. After implementing alternate material for bricks, slab, fine aggregate and door, the re-estimate has to make about Rs.22, 46,000. Finally the saving of Rs.7, 79,000 were made using optimization techniques.

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