



STUDY AND OPTIMIZATION IN BLOCKWORK

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Abstract: Amongst the crucial challenges faced by the developing countries, competent and quality shelter for all people is one of those. The main objective of our research is to decrease the cost and time period of building by using economical and advanced materials like AAC (Autoclaved Aerated Concrete) blocks and without affecting the strength of the structures and improving the quality of work. During building construction masonry work and plaster work are considered as one of the most important aspect to lower the construction cost. We studied that at present both the cost effective and conventional techniques are available in residential construction field. Among these, the cost effective technology has the upper hand over economy in construction. So it can be said that cost effective technology can be taken as a permanent solution to overcome the severe housing inadequacy in the country.

Index Terms – Standard Operating Procedure (SOP), Block work, Checklist,

INTRODUCTION

During the early 70s and before, the technologies used in construction industry were very unadvance, while constructing any structure we generally used M15 grade of concrete and grade of steel used was FE250 also the binding material used was lime. We can observe that earlier structures are more durable and having more strength as well as the quality of construction was also very high as compare to the present structures. For example, nowadays, the grade of concrete and steel use on construction sites generally ranges from M25 to M60 and FE415 to FE700 respectively. With so much of high strength concrete and steel used in today's industry, the required quality of construction as well as the strength is not satisfactory as compare to earlier ones. Now we have advance equipment's more advance technology but us lagging in quality. The question here was "Can Quality be achieved without increasing the cost of project?" and by this project we will try to find out the answer of this particular question.

While doing internship we observe various problems which will directly or indirectly affect the Quality. Problems such as faulty Workmanship, Wastage of materials, Wrong practice, Lack of knowledge. Major problem which is affecting the Quality, Cost & Time is having wrong or improper knowledge of actual practice or correct practice. What we identified was not having the knowledge of standard practice among the workers as well as junior or sometime senior engineer.

Aim

- To shed some light upon the topic by studying the current practices and provide innovative solutions to improve Quality, reduce cost and time.
- To implement the Quality improvement techniques on site.
- To improve the workmanship of labor and increase their skill set.

Objectives

- To study the on-site construction procedure of the activities.
- To prepare the Standard Operating Procedure (SOP) for various construction techniques in RCC Frame structure.
- To prepare the Standard Operating Procedure (SOP) for various construction technique in RCC Frame Structure.
- To prepare the checklist of the activities to improve the quality of construction.
- To Study the delay analysis and try to find out the ways to overcome it.
- To provide innovative solutions to improve Quality, reduce Cost & Time

Literature Review

1) Cost Optimization in Building Construction by Comparing Various Materials in Brickwork.

Author: Kshyana Prava Samal (KIIT University), Aditya Divyadarshi KIIT University

In a building the foundation, walls, doors and windows, these are the most important components for superstructure, which can be analyzed individually based on the need, thus improving the speed of construction and reducing the construction cost. India being a developing country needs to look for the economical techniques, most of the population here belongs to lower income and middle income group (LIG and MIG). It can be concluded that cost estimation is the most important inductive process in any building construction and there are a huge number of cost effective techniques available to deal with problems in construction management. In this paper, case study of an ongoing construction project is being done. We have implemented techniques for construction which will reduce construction time and improve the quality of work. The high depletion of raw materials by the construction area, results in prolonged shortage of building materials and the concomitant environmental impairment. In the past era, building commerce has been conducting numerous researches on the application of easily available raw materials in building. In this present study an effort has been taken to enlighten the use of different types of material in brickwork cost estimation.

- Cost of purchasing materials i.e. cement, fine aggregates and bricks for per m³ quantity is least for AAC blocks compare to other bricks.
- For this project AAC blocks will cost 1.55% lesser than burnt clay brick and 9.8% lesser compare to fly ash brick for the construction of this project.
- For this particular project we will suggest that AAC blocks should be used for the construction of walls as it will cost cheaper compare to other materials.
- We will suggest that AAC block should not be used at those places where it is not easily available as it will increase the cost of transportation and will also affect the total construction cost.

2) Implementation of Block work System in Malaysia

Author: Mohamed Nor Azhari Azman, Farul Afendi Bahari, Rini Kusumawardani, and Tee Tze Kiong

In this study, the research method used is a literature review to see the progress of the block work system to ensure that the studies conducted have the correct basic information through previous studies. This study also uses qualitative methods in the form of interviews. All the result from interview and focus group analyzed using content analysis. The results of the study were discussed through a focus group method to validate the results of the study so that it could benefit the players in the construction industry. A total of 14 panels comprising academics, engineers, IBS block manufacturers and CIDB officials were involved in this discussion the focus group discussions have been conducted to discuss current issues regarding the implementation of the IBS block work system in Malaysia in ensuring that this system is more widely embraced by industry players and users.

3) Aerated Autoclaved Concrete (AAC) Blocks: Novel Material for Construction Industry

Author: Farhana M. Saiyed, Ashish H. Makwana, Jayeshkumar Pitroda, Chetna M. Vyas

ACC is different from dense concrete in the way it is produced, in the composition of the final product and its properties. In aircrete production the autoclave is normally a steel tube some 3 meters in diameter and 45 meters long. Steam is feeded into the

“ACC” at very high degrees of pressure, i.e. pressure of 800 kPa and a temperature of 360 °C. Autoclaved aerated concrete can be produced using a vast range of cementitious materials, commonly: Portland cement, lime and pulverized fuel ash (PFA) OR Portland cement, lime and fine silica sand. The sand is usually milled to achieve fineness.

4) Cost Effectiveness of using Low Cost Housing Technologies in Construction.

Author: Vivian W. Y Tam, School of Engineering, University of Western Sydney.

Low cost housing can be considered affordable for low income earners if household can acquire a housing unit (owned or rented) for an amount up to 30% of its household income. In developing countries such as India, only 20% of the population are high-income earners, who are able to afford normal residential houses. The low and moderate income earners in developing countries are generally not able to access the housing market and quality improving technologies. Cost effective housing is a relative concept and has more to do with budgeting and seeks to reduce construction cost through better management, appropriate use of local materials, skills and technology but without sacrificing the performance and structure.

It is of utmost importance that one should understand that low cost housing are not houses which are constructed with low quality materials and substandard overall quality.

5) Minimizing the Cost of Construction Materials through Optimization Techniques

Authors: Akalya.K1, Rex.L.K, Kamalnataraj.D 1PG Scholar, M.E (CEM) Civil Engineering & Surya group of institution, Villupuram.

In a construction work, cost, time and quality are some of the most important factors to be considered in the planning and execution of every project. The aim of every construction project is to finish the projects with required quality, within a specific time frame, within budget and to achieve other objectives of projects. The various results obtained from the survey and observation concluded that major cause for delay in projects are improvisation on site, changes made in contract, rate of materials in markets, and high level of top most quality requirement and the major cause for cost increment are change in materials and its specification, extra-ordinary transportation cost, and inflated materials price. Material has a dominating role in construction. If the material is controlled properly then the total project cost would be reduced. To achieve this objective, a research methodology has been developed by author to control the material procurement and carrying cost. The cost optimization is a technique that should be executed carefully and thoroughly throughout the construction time frame to ensure that the cost of the building is kept within the desired budget. 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 of project has started.

Methodology:

In this study, the research method used is observing the on-site execution of many construction activities, preparing the standard operating procedure (SOP), checklist for every activity and identification of areas which require improvisation which affects the Cost, Quality and Time.

Following steps to be taken for achieving the above objectives:

- Observing the various construction activities on site.
- Preparing the Standard Operating Procedure (SOP) of construction activities.
- Preparing the checklist.
- Estimation of the activity or cost analysis of the activity.
- Suggesting the improvisation techniques which can be practically possible as per the working conditions of site.

Standard Operating Procedures for Brickwork

STEP 1

Surface where the block is to be laid is cleaned either by broom or by wire brush depending on the type of unwanted material present on the surface. After cleaning the surface a layer of mortar is placed to ensure the proper bond between the block and the surface of slab area where the block work is to be done. Mortar consists of fine aggregate, cement and suitable amount of water as

per the amount of cement and fine aggregate also the temperature and climatic conditions plays a vital role in the water content to be taken .



Fig no (i)

STEP 2

After placing of mortar, Blocks are placed on the mortar and the gap between the blocks is filled with mortar only. Now a day's ready-made mix of cement and fine aggregate is available in the market in a bag of 20kg only we have to add sufficient amount of water in it to ensure the proper workability of the mortar.



Fig no. (ii)

STEP 3

Binding chemical is prepared by mixing chemical into water and having mix proportion of 2.5 part of chemical to 1 part of water. After pouring chemical into water the paste is mix thoroughly with the help of mechanical mixer. Mixer is electrically operated, which should be cleaned every time after mixing.



Fig no. (iii)

STEP 4

Placing of blocks in series with chemical as binding material up to half the level of total height of block work then a layer of mortar is placed having a reinforcement of 10 or 12 mm dia bar.



Fig no. (iv)

STEP 5

Placing the blocks above the layer of reinforced mortar paste up to the slab level or beam bottom level.



Fig no. (v)

Estimation of Block work

Size of block = $640 \times 240 \times 150$

Cost of one block = 50 rupee/block

Area covered by each block = $0.64 \times 0.24 = 0.1536$ square meter

No of blocks required to completely empty one bag of chemical = 50 – 55 blocks

One mason can lay 120-130 blocks in a day

His working hour is from 9am to 6pm which is 9 hours a day in which reduce 1 hour of lunch and another 30min for his own stuffs.

Now he has 7 hours and 30 min in a day (450 min a day).

Suppose he is laying 120 blocks in a day then the average time required to lay a brick is 3 min.

Area covered by one mason = $120 \times 0.64 \times 0.24 = 18.432$ square meter.

Wage of a mason and a labor = $500 + 400 = 900$ rupee

Chemical bag required for laying 120 blocks = $120/50 = 2.4$ bags

From above data we can conclude that for 18 m^2 we are investing 900 rupee.

For $1 \text{ m}^2 = 900/18 = 50 = 50$ rupee

But if we increase one more mason, one labor can serve two masons easily. Our dead cost will increase to $900 + 500 = 1400$, our area covered will be doubled = 36 m^2 .

Now by increasing one mason our 1 m^2 cost will be = $1400/36 = 39 = 39$ rupee

CHECK LIST FOR BLOCK WORK

PRE BLOCK MASONRY CHECKS				
Sr.no	Activity	Yes	No	Remarks
1	Has the contractor cleaned the slab surface before the center line of block work			
2	Center line marked is as per the architectural drawing			
3	Size of blocks as per the requirement			
4	Availability of chemical bag in sufficient no.			
5	Availability of mechanical mixer and supply of electricity is possible			
6	All concrete surface (beam and column) coming in contact with block work is to be hacked			
7	Proper arrangement is made to ensure the chemical – water ratio of mix			
During block masonry check				

1	Chemical mix prepared is as per standard and have optimum workability			
2	Block which is laid is crack free			
3	1 st layer is of mortar			
4	Block work should be in proper alignment with a systematic bond			
5	Dimension of room is checked once after laying of first layer.			
6	All the vertical joints must be staggered			
7	Sill level and lintel level is marked on the adjoining column			
8	Provision of door and window is made as per the drawing			
9	Construction of block work in one go should not exceed 1.5 m or half of floor to floor height			
10	Vertical plumb should be checked			
11	Reinforced mortar is placed after the half height of wall is constructed			
12	Size of windows and doors is as per drawing			

Improvisation on laying technique of block work



Fig.no.(vi)



Fig no(vii)

Conclusion:

- To summarize, Standard Operating Procedure (SOP) proved to be the most important document created to provide strict, proper and effective control over the activities that were completed by labours and workers who were engaged in every small activity of construction activity from planning to execution stage.
- Through SOP we delivered quality workmanship without any delays.
- As an indirect affect it helps to control the over –run of cost due to delay in project.
- People who followed such procedure had more confidence in their outcome.
- SOP for Brickwork was highly appreciated by builders and contractors.
- Quality and efficiency of the work improved as SOP and Checklist was followed on site.
- The time required for completion of activity got reduced.
- Economy was achieved and quality of workmanship increased on site.

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