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A LITERATURE STUDY ON GFRG BUILDING AND LEAN CONSTRUCTION

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Abstract - *Economical plan and development of structures, utilizing green material is an option in contrast to exhaustion of totals and increment in cost of concrete. Glass fiber reinforced gypsum panel (GFRG) is a green material, which is a rapid wall construction method and a cost effective construction process. With the end goal to enhance the productivity, and decrease of waste, the lean the development has been presented as another administration rule for better execution. In India, the usage of lean administration in the development industry is a noteworthy errand. Because of the absence of consideration and uneducated towards the lean administration guideline the proprietor, contractual worker, engineers and so on are as yet creating a stage to actualize this standard in their task. This venture primarily centers on to recognize the potential outcomes of execution of lean administration in the development industry. This paper shows the probabilities of compelling usage of lean administration guideline in the development industry, which can definitely diminish the use of time, increment the nature of work, and benefit rate by wiping out the wastage of materials. It finally, points in giving lodging to all classes of people, in this way enhancing the economy of India.*

Key Words: GFRG Panels, AUTOCAD, Revit, MS Project, Lean Tools.

1. INTRODUCTION

This research aims in providing adequate shelter for all individuals that is one among the recent challenges long-faced by the developing countries. An Asian nation is presently facing a shortage of regarding 17.6 million homes. The dream of owning a house significantly for low-income and middle-income families is changing into a tough reality. The actual key success issue is that the involvement of workers in daily improvement. This may be achieved through a distinct method of leadership, the lean leadership. The point is to consistently enhance each procedure consistently. It involves the selection of low-cost construction materials, which result in a reduction of the total cost of the building. Evaluations are going to be conducted on the performance of current trade follow, with comparisons created against the propositions related to lean construction. Finally, conclusions are going to be drawn on the important worth of lean construction against the traditional practice for a three-storey residential building, with consideration for the future benefits within collaborative technological models. The aim of this research is to apply lean construction Techniques to provide a low-cost Residential Building.

2. LITERATURE REVIEW

2.1 RAPID AFFORDABLE MASS HOUSING USING GLASS FIBRE REINFORCED GYPSUM (GFRG) PANELS

Devdas Menon [2014] discussed a construction of building made in IIT Madras. The building is constructed victimization of GFRG Panels that have made out of mineral, mostly accessible in style of Phosphogypsum, a waste by-product of fertilizer trade and glass fiber as a reinforcing agent, which boosts the strength of the panels. The building panels are appropriate for reasonable mass housing, with the benefits of value effectiveness and fast construction. GFRG panels contain cellular cavities between the outer flanges and the inner ribs, which might handily be stuffed with concrete and strengthened with steel bars, if needed, to appreciate the specified capability as load bearing walls. Buildings engineered victimization this technology with none columns and beams will go all the means up to 8 to 10 storeys in low to moderately unstable zones, and to lesser height in high unstable zones. The empty cavities within the panels may be used for concealing electrical wiring and alternative plumbing works. In an exceedingly typical building, all parts, as well as walls, slabs, staircases, and even parapet walls is also created exploitation GFRG. To demonstrate this technology, a two-floor high-rise GFRG demo building was engineered within the IIT Madras field. This building, made among a span of 30 days housing a complete space of 1981 sq.ft., has 4 flats, two having a carpet space of 269 sq.ft meant for the EWS (economically weaker section), and the alternative two with 497sq.ft carpet space every meant for the low income group. The saving in worth was nearly thirty-fifth, compared to straightforward construction.

2.2 STUDY OF GFRG PANEL AND IT'S STRENGTHENING

Eldhose M Manjummekudiyil et al. [2015] studied regarding GFRG Panel strengthening victimization of very different concrete mixes crammed within the cavities. They used three very different concrete mixtures within the panels for testing. The concrete is a Nominal mix M25, Fly-ash concrete and Recycled Aggregate concrete. The main objective of victimization ash in most of the cement concrete applications is to urge sturdy concrete at a reduced value. The addition of fly ash as additional ingredients at the concrete mixing stage as part replacement of OPC and fine aggregates is a method that is more flexible. It permits for optimum utilization of the standard ash as a crucial element

(cementitious and as fine aggregates) of concrete. Hence, here half-hour of cement is replaced by fly ash. From the results obtained from various tests conducted on GFRG panel, it is clear that the compressive strength is increased with the inclusion of filler materials. Nominal- M25 combine gave most strength once employed in panels. Recycled mixture concrete filler conjointly gave satisfactory strength in compression, and in turn, it leads to an economical method of construction. Fly ash is a by-product of plant food business is effectively used together with the filler material in GFRG Panel.

2.3 A REVIEW OF RESEARCH ON BUILDING SYSTEM USING GLASS FIBER REINFORCED GYPSUM WALL PANELS

Aishwary Shukla, Mohd. Afaque Khan (2016) researched on wall panel building system. This paper surveys about advancements in the field of building frameworks utilizing glass fiber strengthened gypsum boards. GFRG boards, made in institutionalized parts or segments prepared for quick gathering and erection as structures are instant gypsum boards with empty depressions. This Rapid divider is used in private and business built abodes. At the point when the empty depressions of GFRG boards are loaded up with strengthened self-compacting concrete, the security between the solid and the GFRG boards yields another composite. Thus, the auxiliary execution of Rapid wall and the related building frameworks are more complex than that of other ordinary building systems. It likewise includes the investigation of a reaction of the long way or longitudinal support on intermittent or cyclic shear conduct of GFRG boards and its sturdiness.

GFRG boards have a significant hub and shear quality when depressions of the board are loaded up with strengthened cement and along these lines are pertinent for development of multi-story structures. GFRG board faces the especially similar issue as that of solid shear dividers, i.e., concern with respect to the satisfactory association between the precast units.

The GFRG cavities are loaded up with cement; however, the bond as though in other customary building frameworks is not indistinguishable in it. The bond among cement and GFRG divider surface is neither solid nor dependable. Be that as it may, the excellence is that as long as we assembled them and interface them and make them into a unit really the absence of bond is additionally beneficial on the grounds that there will be the loss of vitality. The vitality can be disseminated through fraying of surfaces and making the structure somewhat more adaptable. Every one of these things helps in tremor execution of this GFRG building framework. Shear disappointment method of GFRG dividers was very not quite the same as that of strengthened solid shear dividers. As in RC shear dividers, the shear disappointment modes were corner-to-corner strain disappointment, slanting pressure disappointment, and shear sliding disappointment while in GFRG boards it is diverse because of the detachment of the solid centers by the interior ribs of the GFRG board. The run of the mill shear disappointment mode watched was a longitudinal shear in the gypsum mortar.

In view of the exploratory outcomes, a planning method for the building framework has been proposed. The long way fortification has no noteworthy impact on the shear reaction of cement-filled GFRG boards. Consequently, boards with starter bars as support could be utilized for which shear disappointment controls the structure. Hub stack similarly affects the shear quality of the dividers. Accordingly, Starter bar is satisfactory for GFRG divider building if disappointment is because of shear quality of the divider. Nonetheless, this is only legitimate for shear winning divider boards. They are not legitimate for the dividers with flexural distortions, for which the coherence of support is significant.

2.4 COST MODEL FOR USING GLASS FIBRE REINFORCED GYPSUM SYSTEM (GFRG)

Mohamed Said MeselhyElsaeed (2016) Studies about the GFRG framework and configuration cost model to examine coordinate expense for the framework amid the planning stage. The market cost for this framework is separated into two fundamental perspectives; cost and increase. The increase viewpoint is separated into the possibility, which is principally identified with hazard investigation and it contrasts regarding the site, proprietor and venture. The other angle is net revenue, which relies upon market status and plausibility examine for the undertaking. Cost viewpoint is partitioned into two stages, which are the immediate cost and roundabout expense. Increase and circuitous cost perspectives cannot be broke down in this exploration, as they are venture-arranged viewpoints. The paper plans to break down the immediate cost angle for GFRG framework and configuration cost show amid the structure stage; to accomplish the improvement level for a framework. It partitioned in two sections; a hypothetical viewpoint will examine the building configuration utilizing Glass Fiber Reinforced Gypsum boards as per structure manual, establishment manual, and framework necessities. Useful perspective concerning the cost of Glass Fiber Reinforced Gypsum amid activity process, notwithstanding that, information was accumulated from various tasks utilizing GFRG framework concerning development cost and establishment techniques on location. The immediate expense of GFRG framework for structures, accepting that there are three hundred working days out of each year, eight working hours out of each day and one GFRG board is worked in thirty minutes, and realizing the impression and developed zone for the building.

2.5 LOW COST HOUSING BY USING GFRG PANELS

Sk. Subhan Alisha et al. [2016] discovered gypsum is a tough material, and it is as of now vigorously being used as parcel dividers. Specialists foresee that a building made of GFRG boards can have a life expectancy of 60 years. A GFRG building does not require the United Nations Framework Convention on Climate Change (UNFCCC) has

endorsed beams, columns, and the material as a green building material. The panel cavity can be mostly or completely loaded up with fortified cement to give extra quality.

The establishment cost comes to around 10 to 15% of the aggregate building. It is recommended to receive as curve establishment in common soil for affecting a decrease in development cost up to 40%. The conventional R.C.C. lintels, which are expensive, can be substituted by block curves for little ranges and spare development cost up to 30 to 40% over the conventional technique for development. By embracing soundly, structured development rehearses like filler section and precast components the development cost of material can be diminished by around 20 to 25%. It is watched that the development method and strategies are being utilized for GFRG boards development, finish cost and estimation of building, pertinent methodology utilized for a board assembling, investigation, and term of each component of the building. Here we learned about how to decrease cost by assessing the number of materials for various building parts, and in this manner assessing the aggregate expense of the task.

2.6 IMPLEMENTATION OF LEAN CONSTRUCTION TECHNIQUES FOR MINIMIZING THE RISKS EFFECT ON PROJECT CONSTRUCTION TIME

Usama Hamed Issa (2013) shows this construction involves numerous risk factors that have numerous impacts on time objective that will cause time-overrun. This study suggests and applies a replacement technique for minimizing risk factors result on time mistreatment lean construction principles. The lean construction is enforced during this study mistreatment the last planner system through execution of an industrial project in Egypt. Evaluating the result of mistreatment the new tool is delineated in terms of two measurements particularly, percentage Expected Time-overrun (PET) and percentage set up Completed (PPC). The foremost vital risk factors are known and assessed, whereas PET is quantified at the project begin and through the project execution employing a model for time-overrun quantification. The results showed that the total project time is reduced by 15.57% because of decreasing PET values, whereas PPC values improved. This can be because of minimizing and mitigating the result of most of the danger factors during this project because of implementing lean construction techniques. The results evidenced that the quantification model is appropriate for evaluating the result of mistreatment lean construction techniques. Additionally, the results showed that the average worth of PET because of factors struck by lean techniques represents sixty-seven from PET values because of all decreased risk factors.

2.7 ROLE OF LEAN TOOLS IN SUPPORTING KNOWLEDGE CREATION AND PERFORMANCE IN LEAN CONSTRUCTION

Lianying Zhang[a], Xi Chen[b] discovered the usage of lean development largely depends on hierarchical learning and information creation, which is advanced by lean strategies. Notwithstanding, there are few investigations in information administration of lean development. This paper attempts to fill the hole and sets up a linkage between systems in lean development and information administration through the SECI (socialization, externalization, combination, internalization). Along these lines, an arrangement of lean procedures is proposed and recommended to help to learn the creation process. At that point, the creators particularly exhibit how these systems fit into the procedure. A poll overview was led to affirm the suppositions a while later. The outcomes demonstrate that lean instruments positively affect information creation lastly advance lean execution. This exploration can see how lean systems assume a job in making information, which will support the learning administration of lean development. Consequently, this paper attempts to fill the hole, breaking down how lean strategies can advance learning creation process, to help enhance information administration framework in lean development undertakings; and in the meantime, researching information creation's intermediation job in lean devices' effect on lean execution. The main commitment of our exploration is to stress the exceptional job of learning creation in lean devices' adequacy. Second, set up a connection between learning creation and lean reasoning.

2.8 EFFECTIVE UTILIZATION OF LEAN MANAGEMENT IN CONSTRUCTION INDUSTRY

A. ChandrasekaR, M. Logesh Kumar, shows this paper mostly centers on distinguishing the potential outcomes of execution of lean administration in the development industry. Setting up the survey and furthermore directing the meeting with the venture personals like best administration, designers and site administrators and so forth will accomplish it. The polls were assessed to receive the systems through factual strategies. This paper exhibits the conceivable outcomes of powerful use of lean administration rule in the development industry, which can definitely expand the nature of work and benefit rate by dispensing with the wastage of materials. With the end goal to enhance the proficiency and decrease of waste, the lean development has been presented as another administration guideline for better execution. Presently a few development organizations from USA, UK, Australia, Brazil, and Singapore are begun to actualizing the lean development with amorphous any desires for acquiring better outcome from their current tasks. There are numerous difficulties to actualize the lean idea in the development industry. In India, the usage of lean administration in the development industry is a noteworthy undertaking. Because of the absence of consideration and ignorant towards the lean administration rule the proprietor, temporary worker, engineers and so forth are as yet creating the stage to execute this standard in their undertaking. Therefore, this paper points to enhancing this current stage.

2.9 LEAN CONSTRUCTION: TOWARDS ENHANCING SUSTAINABLE CONSTRUCTION IN MALAYSIA

Mohd Arif Marhani, Aini Jaapar, Nor Azmi Ahmad Bari, investigated that the lean Construction (LC) is gone for diminishing waste, expanding profitability and wellbeing and security in satisfying the of the development business. This paper gave crucial information about on LC and featured its execution in the development business. It was found that the learning of partners is sensibly huge as the standards of LC is broadly executed in the work field. Nonetheless, the partners are aloof in their comprehension on the essential wordings of LC consequently unfit to harvest its maximum capacity. It was demonstrated that by actualizing LC, the development business benefits by boosting esteem and enhanced manageability. Material choice is a key advance in item structure and ordinarily goes for distinguishing the most reasonable material that meets item execution objectives at least expense. As of late, research has been driven for creating practical arrangements at aggressive expenses. This work assesses the manageability of innovative sandwich-organized composites for novel lodging arrangements.

The primary goal of this paper is to give a premise of basic information and comprehension on LC for Malaysia development partners. A broad writing survey was led with the end goal to accomplish the targets of this paper. This paper is additionally gone for featuring on the best way to fuse the LC idea in the development business to advance supportable development.

2.10 LEAN LEADERSHIP FUNDAMENTAL PRINCIPLES AND THEIR APPLICATION

U. Dombrowski[a], T. Mielke[a], shows this paper aimed for recognizing the significant standards of lean administration. A resulting review uncovers the utilization of lean initiative and calls attention to future potential outcomes for development. The lion's share of members affirms the specific significance of lean authority and guarantee to apply every one of its components in their undertakings. In any case, the outcomes additionally demonstrate that a few components have been misconstrued and others are not utilized as altogether as they should. Lean Production Systems (LPS) have moved toward becoming best in class in the present generation offices. Yet at the same time, few undertakings prevail about keeping up a feasible continuous improvement process (CIP). In numerous LPS, exclusively techniques and apparatuses are in focal point of the execution. Nevertheless, they simply speak to the shallow components of LPS. The real key achievement factor is the contribution of workers in day-by-day enhancement. This can be accomplished through an alternate method for administration, the lean authority. Despite the fact that numerous creators have just underscored the significance of lean administration, so far no reliable structure or meaning of this methodology exist. Therefore, this paper endeavors to rectify this problem.

3. CONCLUSION

This paper shows about the study of GFRG and lean construction. From the above study, GFRG is more economical than conventional buildings. Thus, GFRG panels can be effectively used for the entire superstructure of buildings, including all walls, slabs, staircases, parapets, and so on. This building framework has numerous points of interest over traditional structures. GFRG structures can possibly address the difficulty of giving quick moderate mass building. This is an eco-friendly and economical building framework, making utilization of reused mechanical waste gypsum or normal gypsum and limiting the utilization of bond, steel, sand, water and work input. In Lean Construction, proprietor, architects, general and strength temporary workers, and providers cooperate to create an esteem including, constructible, usable, and viable office. The amplification of the work process, not point speed, through the minimization of execution variety and the disposal of foundational, squander sources, is a key foundation of Lean Construction.

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