ANALYSING PRECAST & MODULAR CONSTRUCTION WITH RESPECT TO DESIGN AND COST

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Abstract:

The article investigates the use of modular modules as a temporary approach in the field of building. This paper examines the global expertise in the field of modular construction. The significance of modular construction lies in its ability to expedite project design and engineering processes, save expenses, and enhance construction efficiency. The use of modular buildings is characterized by its cost-effectiveness, safety, and environmental friendliness. Contemporary modular systems are predicated upon the use of not just voluminous components, such as "block rooms," but also diverse little 3D architectural constituents. The analytical findings pertaining to Russian advancements in modular building construction demonstrate Russia's extensive expertise in the creation of 3D reinforced concrete modules. According to the study findings, the article demonstrates potential for the advancement of contemporary modular building systems, with the aim of offering economical, pleasant, and environmentally sustainable housing options to the people. This study presents an analysis of the potential and significance of using modular prefabricated modules in both low-rise and high-rise construction.

Keywords: Modular, cost-effectiveness, Safety, 3D reinforced concrete, effective construction of cast

1.0 INTRODUCTION

Over the years, the constructing marketplace's traditional construction methods have proven to be labor-intensive and fraught with issues related to quality control, procurement costs, shifting weather patterns, and health and safety, among other things. From a business perspective, work-related illnesses and injuries in construction projects often have an impact on the projects' profitability. Medical expenses, workers' compensation, liabilities, benefits, and property losses are among the expenditures that are directly linked to illnesses and injuries sustained on the job [1]. The cost of labor accounts for around 30% of the total project cost when considering productivity and quality [2]. A study by [3] on labor mismanagement and building delays revealed that 40–60% of a normal construction worker's day is spent inactively. As found by [4],

the cost of construction rework (re-doing a portion of the construction because of subpar craftsmanship; manuscript received August 29, 2017; revised December 10, 2017) accounts for approximately 12% of the total construction costs, excluding losses resulting from lawsuits, delayed schedules, and other impalpable costs of subpar quality. Construction workers and their families have suffered greatly as a result of poor job quality and hazardous working conditions, which have cost customers, businesses, and the public millions of dollars [5]. Outside of the site As a sustainable construction method, modular construction is setting new global standards for productivity in the building and construction industry, thereby lowering the negative social and environmental effects that result from the activities of conventional construction methods. Working on construction sites is now one of the riskiest

vocations in the world, and the mortality rate from construction is rising as well, with Europe having the highest rate of 23%, led by Germany, France, Spain, the United Kingdom, and Portugal [6].

2.0 PROBLEM STATEMENT

As a consequence of the complex nature of construction, contractors can encounter challenges in delivering projects of high quality to customers, leading to the presence of many inaccuracies in certain projects. The use of inferior and faulty materials in order to minimize building expenses together adds to the delivery of poor projects. The potential occurrence of accidents among site employees at construction sites might disrupt site operations for a certain duration, therefore augmenting the contractor's responsibility to cover health and insurance expenses. This, in turn, contributes to the entire project cost and inevitably diminishes profitability.

3.0 AIM

The primary goal of this article is to conduct a thorough examination of the topic under discussion in order to comprehensively understand how Off-site Modular Construction can be utilized to enhance productivity, decrease the number of on-site workers, reduce on-site work hours, and mitigate construction risks, ultimately leading to improvements in Construction Quality and Safety.

4.0 METHODOLOGY

The initial stage of this mini thesis involves doing a comprehensive literature research that elucidates the concept of modular construction, its advantages, cost analysis, comparisons, and the fundamental comprehension of the elements that contribute to cost effectiveness.

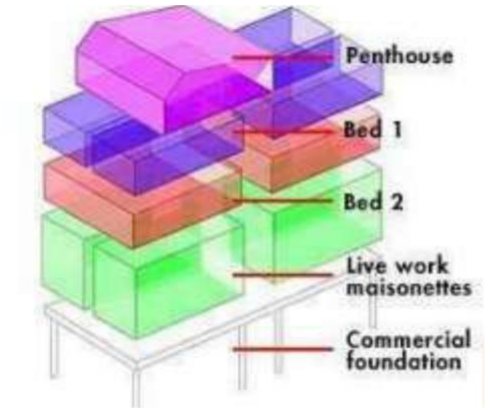
During the subsequent phase, following the attainment of a comprehensive comprehension of modular construction and its various typologies, as well as its associated advantages, it becomes imperative to undertake an extensive survey to assess the current status of modular construction in India. This endeavor necessitates on-site visits and meetings with key personnel from diverse departments within companies involved in the implementation of this construction methodology. The data gathering process will be enhanced by including inputs from various sources inside the building sector, as well as soliciting feedback from the general public. This approach aims to ascertain the public perspective of the aforementioned procedure.

The necessary data will be gathered via the aforementioned techniques, as well as through the use of online resources.

The third phase starts out with the conclusion of data collection, during which the obtained data is subjected to analysis and organized in a coherent and comprehensible way.

I. WHAT IS MODULAR CONSTRUCTION?

The idea of modular construction refers to the construction method whereby a building is constructed by assembling a sequence of volumetric steel modules that are interconnected to create a fully integrated structure. The modules, which are produced and completed (either fully or partly) at off-site locations, under controlled manufacturing environments, are afterwards brought to the construction site and installed into pre-arranged foundations. Subsequently, the structure is linked to utility systems, and the outside surface of the edifice is adorned with cladding and roofing materials.



Modular building is considered to be a more ecologically sustainable approach to construction when compared to conventional procedures. This is mostly due to the reduced need for extensive foundations during the installation process. Additionally, the modular components and foundations may be prepared concurrently, resulting in substantial time savings in the construction process. Significantly, the production of modules in industrial settings plays a crucial role in minimizing the probability of faults and enhancing quality control measures. Although modular construction draws upon processes used in the manufacturing business, the final outcome does not have the characteristic appearance of being "mass produced". It is possible to create intricate structures that possess a high level of sophistication and may be readily tailored to meet specific individual needs. The use of suitable cladding and roofing enables the structure to harmonize with its immediate surroundings.

A Comparative Analysis of Modular Construction and Traditional Construction Methods

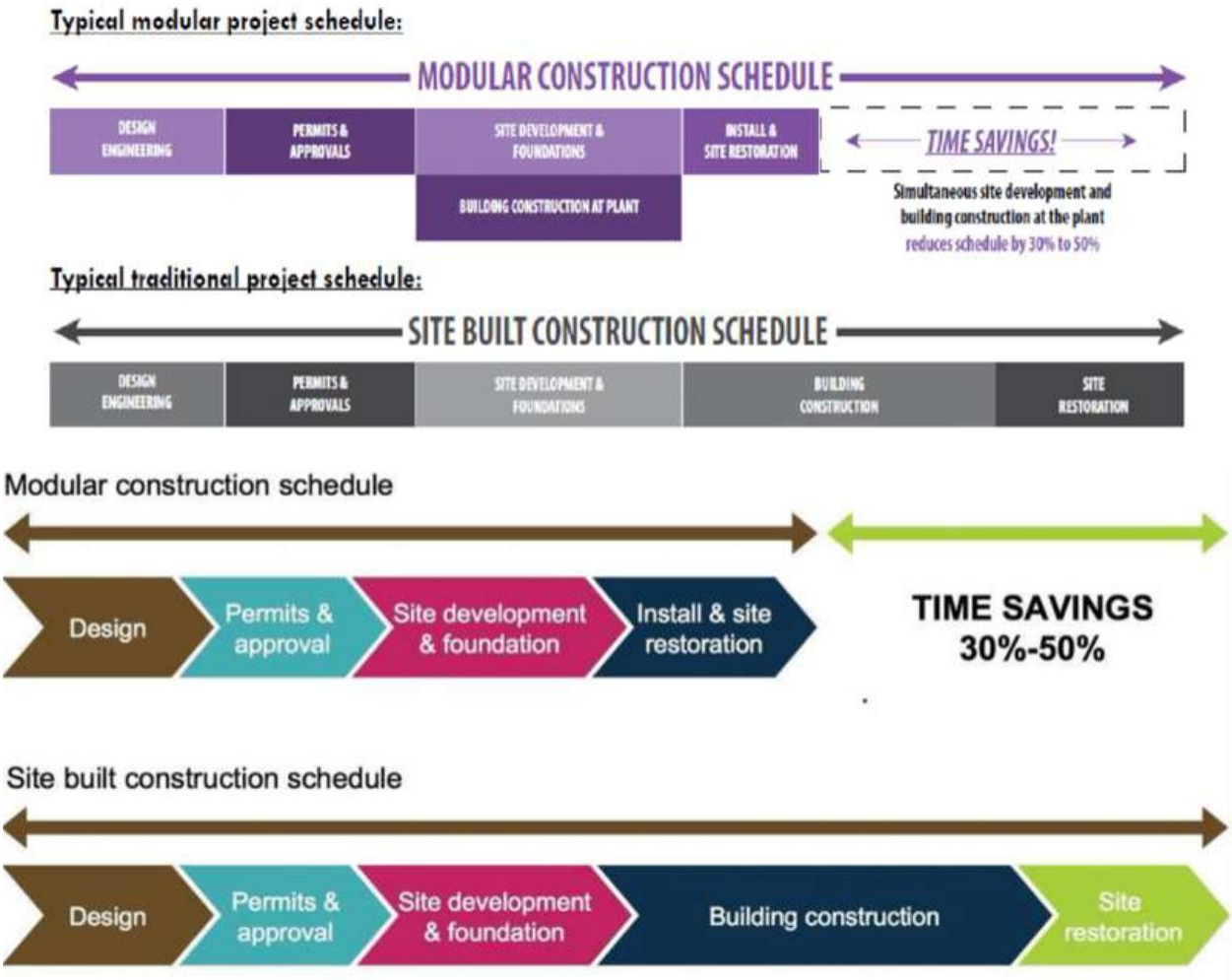
II DESIGN PARAMETERS

The modular field has seen significant advantages as a result of advancements in engineering and computer software. The achievement of design and customisation, which was formerly challenging, has now become far more accessible. The use of a hybrid approach using modular

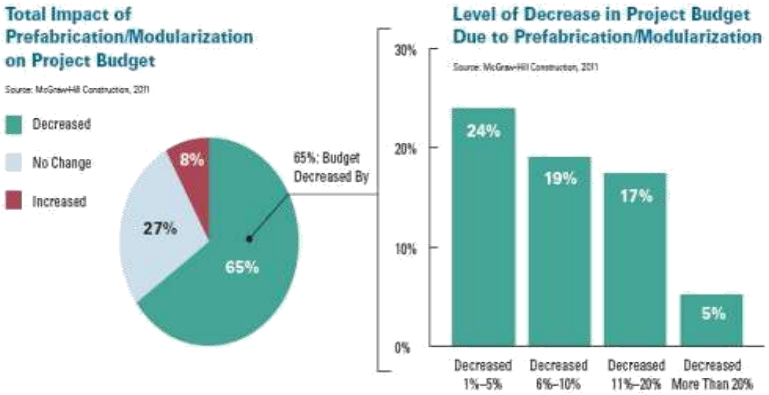
construction, in conjunction with either panelized or site-built building methods, enables developers to create a wide range of structures. The primary design constraints arise from shipping rules and the inherent structural characteristics of a modular container. The constraint of a maximum width of 16 feet presents challenges in designing rooms that can accommodate expansive, open areas. The most effective approach to achieve this objective is integrating two modules and removing the barriers between them. The incorporation of further structural reinforcement enables the attainment of a 16-foot aperture. The height restrictions, which include the trailer, are roughly 13'6", so imposing a constraint on the maximum height of the completed ceiling to around nine feet. A ceiling height of 9'6" is often achieved by the implementation of a tray ceiling, however it should be noted that this represents the uppermost limit. Just as in the case of site-built construction, the cost of constructing a structure increases proportionally with the height of its ceiling. Expanding the width of a module used in construction incurs additional costs, both in terms of building expenses and the need for transit licenses, off-hour shipments, and related logistical considerations.

III THE MOST ECONOMICAL CONSTRUCTION METHOD IS MODULAR CONSTRUCTION.

The modular sector has seen significant advantages as a result of advancements in engineering and computer software. The process of design and customisation, which was formerly characterised by significant challenges, has now undergone a notable transformation, resulting in enhanced ease of execution. The use of a hybrid approach using modular construction, in conjunction with either panelized or site-built building methods, enables developers to create a wide range of structures. The primary design constraints arise from shipping rules and the inherent structural characteristics of a modular container. The constraint of a 16-foot width restriction presents challenges in designing rooms with expansive, open layouts. The most effective approach to achieve this objective is integrating two modules and removing the partitions between them. The possibility of achieving a 16-foot opening may be realised by including more structural support. The height restrictions, which include the trailer, are roughly 13 feet and 6 inches, so imposing a constraint on the maximum height of the completed ceiling to around nine feet. A ceiling height of 9'6" may be often achieved by including a tray ceiling, however it should be noted that this is the uppermost limit. Just as in the case of site-built construction, the cost of constructing a structure increases proportionally with the height of its ceiling. Expanding the width of a module used in construction incurs additional costs, including increased construction expenses and the need for transit licences, off-hour shipments, and related logistical considerations.

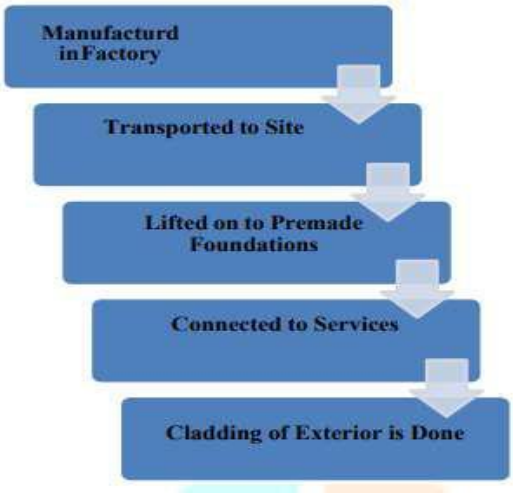


A shorter duration for achieving occupancy results in enhanced productivity, increased revenue production, and better cash flow for the end-user across many sectors. For instance, expediting the construction of a medical centre enables prompt access to healthcare services for patients, while the timely inauguration of a school facilitates the swift commencement of pupils' educational pursuits. When the construction process is expedited, the initiation of billing might occur at an earlier stage. One additional benefit of modular construction is the availability of flexible financing options that are exclusive to this particular form of constructing. These options include the off-balance sheet treatment of building assets and the ability to manage facilities as an operational expenditure, rather than include them within capital budgets. The provided source is an article from the May/June 2022 edition of DCD



IV MODULAR CONSTRUCTION SYSTEM

The phrase "modular building" refers to a construction process whereby the building components are produced and constructed in a systematic manner inside factories, as opposed to using traditional techniques of construction. (Note: In a conventional construction method, all building activities are completed on site.)



V. PROPOSED METHADOLOGY FOR CONSTRUCTION

5.0 CONCLUSION

The current need is the provision of cost-effective housing accompanied by sufficient amenities. Modular buildings, as a whole, has the capacity to derive advantages in terms of enhanced material quality, increased building performance, and sustainability, among other aspects. Furthermore, it can be seen that the implementation of production in a factory setting yields enhanced worker productivity and fosters a safer and healthier workplace in the context of modular building, as opposed to on-site construction. Modular construction is a viable solution for achieving cost savings via the utilization of crane and material rentals, as well as the optimisation of General Conditions and General Requirements, including flagging and on-site offices. Furthermore, this building method facilitates a decrease in labour pay**.**

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