



INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Review on How Modular Construction Technique Can Be Used As Isolation Unit In Pandemic

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Abstract— Modular Construction is a term used to portray the utilization of manufacturing plant which creates pre-engineered constructing units that are conveyed to site and gathered as enormous volumetric segments or on the other hand as significant components of a structure. The measured units may shape total rooms, portions of rooms, or separate profoundly overhauled units like latrines . The assortment of discrete measured units as a rule frames a self-supporting construction by its own doing or, for tall structures, may depend on a free primary system.

Keywords— Isolation, Covid-19, Modular construction, Light weight, Fast construction, manufacturing.

I. INTRODUCTION

The novel coronavirus (COVID-19) poses a threat to the public health system in India and other countries throughout the world. As of January 1, 2021, a total of 1,02,86,709 confirmed cases have been reported in India with 98,83,461 recoveries . As the epicenter of the COVID-19 in India, there was of many new cases in Maharashtra. Beginning at the end of March 2021, many patients in Maharashtra were unable to see a doctor and were hospitalized, and the escalating number of confirmed and suspected cases overwhelmed the admission capacity of the designated hospitals.

Faced with such a grim situation, the Indian government and the state government made a quick decision to quarantine and treat patients with confirmed infections. Hospital were placed into service, the persistent shortage of hospital beds and medical supplies was eased, which was an important step toward controlling the growing epidemic and improving the recovery rate. The number of cases declined after intensive care taken by the government by implementing strict laws, which resulted in easing the pressure on the medical field. But at the end of February, the cases in India spiked. Considering the fire spread of pandemic and the serious shortage of hospital beds and medical supplies in the country and its state, the application of field isolation centers with the help of civil engineering technology called modular homes can be useful in combat against the pandemic.

According to the standards given by World Health Organization, separation is an imperative boundary in halting the spread of the infection. Because of the unexpected shock of cases, there was a deficiency of treatment and isolation unit in

numerous territories of India. The idea of the field emergency clinic is not new it starts from the war zone and has been applied during crises, for example, catastrophic events and quickly advancing infection flare-ups. In any case, the plan and development of Huoshenshan Hospital and Leishenshan Hospital merit uncommon consideration.

At the point when a measured structure is requested, it tends to be a custom structure, or requested from a organization's current line of items. Regardless, developments happen indoor in a plant climate, with the plant making at least one modules, contingent upon the size of the building. Every module is absolutely independent, including everything from the material to the electrical wiring, and the modules are completely completed inside. The size of the modules is by and large restricted by simplicity of transport, with organizations not making modules which are excessively huge or as well hazardous to move without any problem.

II. MODULAR CONSTRUCTION

A. Significance

In light of similitudes in the assembling cycle, a few organizations for instance, Palm Harbor Homes, among numerous others (U.S.A Based) form the two sorts in their processing plants. Measured homes are shipped on flatbed trucks as opposed to being towed and need axles and a car type outline. Nonetheless, a portion of these homes are towed behind a semi-truck or rock on a casing like that of a trailer. The house is as a rule in two pieces and is pulled by two separate trucks. Each casing has at least five axles, contingent upon the size of the home. When the home has arrived at its area, the axles and the tongue of the casing are then eliminated, and the house is set on a substantial establishment by an enormous crane.

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B. Properties and Specifications

Particular development' is a term used to portray the utilization of processing plant created pre-designed structure units that are conveyed to site and gathered as enormous volumetric segments or as generous components of a structure. The measured units may shape total rooms, portions of rooms, or separate profoundly overhauled units like latrines or lifts. The assortment of discrete measured units ordinarily shapes a self-supporting construction by its own doing or, for tall structures, may depend on a free primary system

All modular construction is most commonly associated with cellular type buildings such as student residences or key worker accommodation. For these applications it has the following features:-

- Size of units is limited by transport (3.6m x 8m is typical)
- Open sided units can be created (by changing the floor orientation)
- Modules are stacked with usually no independent structure
- Self-weight of 1.5 to 2 kN/m²
- 4 to 10 storeys (6 is usually the optimum)
- Fire resistance
- Acoustic insulation

C. Types of Module

The type's modules can be depicted as sorts of models that can be produce under this interaction. Choice of the module relies on the reason, accessible space and degree of utilization. The accompanying sorts of modules might be utilized in the plan of structures utilizing either completely modular construction or in minded form of steel structure.

Selection of the module mainly depends on the purpose of usage. The purpose can be for residential, commercial or for emergency uses such as isolation unit as mentioned in this paper. Some of the mainly used modules are four side module, partially open sided module, non load bearing module, tall mixed module.

For the requirement of this separation unit the author has suggested the use of partially open sided module. This module will help in easy accessibility for the doctors with the patient. It is also easy to manufacture easy to install. Further changes can also be done as per the requirement of the situation.

D. Manufacturing Process

Since the creation of modules ought to be considered as a component of the plan of secluded ventures, designers should have something like an overall thought of how the measured assembling process functions. For instance, planners ought to comprehend the focal job of computerized advances in the creation of particular segments, including building data the board (BIM) instruments, PC supported plan (CAD) devices, and PC helped fabricating (CAM) apparatuses. Engineers ought to likewise see how these instruments can uphold mass customization, the strategy by which measured makers produce custom design at a cost effective industrial scale.

Unlike traditional on-site construction, in which the building is generally completed from the outside in, prefabricated volumetric building modules are typically constructed from the inside out. In such cases, the box frame of the module is first completed, then interior finish is added, insulation are installed, and, finally, exterior sheathing and cladding is applied.

The industrial manufacturing process is carried out in total eight phases. In phase 0 the general assembly and connections are carried out. Next phase that is phase 1 which includes

external wall framing and floor framing which are mounted from the chassis from phase zero.

The ceiling is attached to the box and portions wall are installed in phase 2. As the portions walls are installed rough plumbing work is carried out like setting outline of the pipes and other plumbing equipment's. Rough electrical work and foam spraying is carried out in phase 3 and 4 respectively. These are the two phases were the unit takes its desired shape

As the interior work is completed in above phase, the external plywood work is done in phase 5. Here the cleaning of the unit is also carried out.

As the walls are installed, they are now painted in phase 6. Before painting the walls the extra and sharp edges are cleared in this phase if present any. The plumbing and electrical work which was carried out earlier is completed and checked in phase 7. This phase also carries out inspection to detect the defects if present any.

The units need to be waterproof. So in phase 8, the waterproofing work is completed. Also the doors and windows are installed in the empty spaces. The process is completed when the unit manufacture in the industry is transported and installed at the desired location of construction.

Entire manufacturing process in pre calculated and pre-determined. This helps in smooth functioning and precise production.

III. MATERIALS

The term of Prefab is utilized as a short type of pre-assembled structures. Prefab is a wide development lessens site squander with 44% demonstrating that it decreased site squander by 5% or more. Moreover, 62% of respondents accept that these cycles diminish the measure of materials utilized with 27% showing construction/modularization decreased materials utilized by 5% or more.

E. Walls

A structural insulated panel (SIP, also called a sandwich panel) consists of a pair of oriented strand board (OSB) or plywood panels with a core of extruded polystyrene (EPS) foam in between, attached with an adhesive. Panels are available in a variety of thicknesses. They are usually produced in 8-ft-tall panels, but they can be customized as per the requirement. Its peculiarity is that the foam in the core is the best insulator and its thickness determines the value of insulation.

While the EPS froth center gives no sustenance to bugs, it offers a simple way for them to burrow into the construction. Borate added substances can be blended into the froth during make, giving some measure of bug obstruction.

Insulating Concrete forms (ICFs) are a prefab development material which comprises of empty EPS froth obstructs that are stacked and stuck together on location, making a structure that is loaded up with building up bars and cement. The special property of ICFs is that the froth blocks are not taken out after the substantial solidifies; all things being equal, they assist with protecting the structure, while the substantial gives primary trustworthiness. Despite the fact that ICFs are actually a half breed prefab material, they offer a large number of the expense and ecological advantages of unadulterated prefab. In examination with customary substantial development, it is quicker to stack ICF froth blocks than to fabricate a wood structure, and since the froth blocks are not taken out, there is considerably less wastage. They can also be used as soundproof material.

GFRG (Glass fibre reinforced Gypsum) is a product introduced in India by Rashtriya Chemicals & Fertilizers

Mumbai. The Australian Technological breakthrough of combining glass fiber strands with Gypsum Plaster produced in an energy Efficient fluidized bed claiming process resulted in GFRG panels ,which have desired properties of strength and water resistance. Typical dimension of GFRG building panels are 12 m Long ,3m high and 124 mm Thick with modular cavities. .Each segment of Panel contains four cells, thus each panel has 48 modular cavities of 230mm*94mm*3mm dimensions. The Cellular cavities are formed between two outer skins. This makes the panels very light and weight of these panels is 10-12% of weight of comparable concrete or brick masonry.

F. Roofing and Flooring

GFRG Panels gives another technique for building development in quick track, completely using the advantages of pre-assembled, light weight huge boards with particular cavities and dependable, regular cast-in-situ constructional utilization of cement and steel support. By this interaction, labor, cost and season of development is decreased. These of scant regular assets like stream sand, water and rural land is essentially diminished. These panels' boards have decreased exemplified energy and require less energy for thermoregulation of insides. Structures made in this manner diminish troubling of the climate and help to lessen a worldwide temperature alteration use additionally secures the lives and properties of individuals as these structures will be impervious to cataclysmic events like quakes, twister, and fire and so forth.

G. Doors and Windows

Empty metal edges are generally excellent trade for wooden entryway/window outlines. It can likewise be given the vibes of a wood outline at an extremely practical cost and enjoy other upper hands over wood. The casings are termite evidence and climate confirmation and have a preferable surface completion over wood. It very well may be furnished with wooden shades or empty metal screen or glass screen. The screen can likewise be furnished with rock fleece, mineral fleece, PUF, Ceramic fleece or polystyrene protection.

IV.METHODOLOGY

Modular Construction is a relevantly underestimate or we can this technique is overlooked by the engineers. Thus it is necessary to boost this technique more into Indian civil engineering filed so that the use of this concept as is used to the fullest. The procedure for designing and planning of isolation centers using modular homes will include following three stages. The stages are

- Filed survey
- Market survey
- Manual Design

H. Filed Survey

As we all know the pandemic travelled all over the world. The carries were identified as tourists who entered India through international borders. Given that the passengers who landed from abroad were isolate by immediate effect into isolation, the wide spread of the virus would have been decreased. So identification of areas where there are more travelers will help us in identifying how many people are landing from worst affected areas, this people should be

immediately isolated. People coming from semi or low infected area can be home quarantined as well. Speaking for areas away from airports and railway stations, such isolation cabins can be erected outside the town. The site selection should be such that, people coming from airports or abroad will directly entre the isolation center. Here they will be kept under observation and track of their test will be kept. This will reduce the risk of the virus entering the city and its spread.

The main aim of the preliminary investigation was to obtain feedback on the survey questionnaire, which was further improved for the main survey. Initial findings suggested that the hotel/resorts visitors' face quite a bit of fear and hesitation for allowing there space as isolation centers. Schools and colleges were used as isolation, which still used, where there not enough sanitation facilities, water facilities and ventilation facilities. Many of the isolation which was found in in filed survey were schools and colleges. But the issue with this selection was these structures were designed in such a way that people will accommodated the space for a very specific amount of time.

For example the school hours are from 8am to 2 pm. considering this factor the sanitation facilities are small that is one toile in common for many students.³⁶ The rooms of school are designed for holding number of people at once, but the concept of distancing was found missing. People can be kept in isolation in school classroom but due to insufficient distance between two people there is still risk of spread of virus.

I. Market Survey

Upon conducting market survey on the manufacturers and suppliers of modular homes there were few India based manufacturer found. The data collected from them is discussed below. The market survey gives us idea about the availability of materials and there extent of use. It is therefore beneficial in planning and designing process. The manufactures found from the market survey were Loon crafts Utter Pradesh, TATA Steel, Champion Prefabs Karnataka.

J. Manual Design

The manual design includes planning of the building. Floor plan was prepared with the help of CAD software. The plan shows isolation unit which can isolate two patients at a time. The unit has two beds and one washroom. The bedside area of the patient will have all the necessary equipment's such as oxygen concentrator, PCR test kits and sanitation kit.

Portion wall will be placed between two beds, this will stop the influence of one person on the other. Two separate washbasins are proved for cleaning purpose. The water will be carried from a water tank which will be placed outside the unit.

The size of the unit is 5 m X 6 m as shown in the figure 1. The buffer zone of the patient can be kept up to 2.8 m. This zone will strictly accessible only to the doctors. This distance will be approbation to stop the travel of the virus. At the end of buffer zone there will be a observation screen. This screen will be transparent.

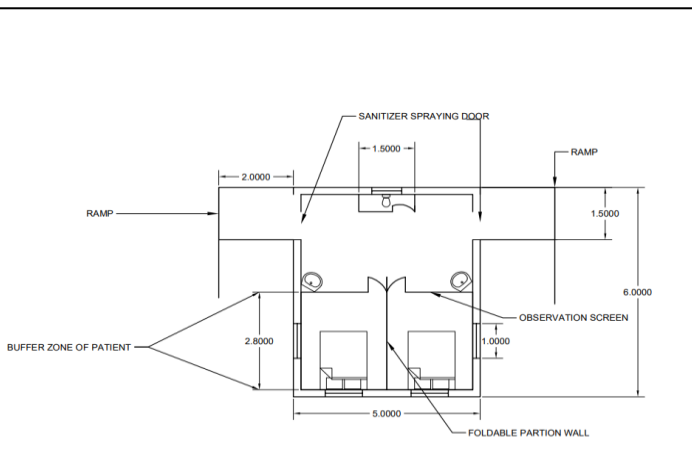
There are two separate entry section for two patients. There will be a ramp on each side just in case the patient is handicapped. At the entry of the gate, there will be sanitation sprayer. This will help in complete sanitation of the person entering the unit.

The entire structure will be in steel and the walls will be sided between roof and floor sections. The material selection all depends on the the engineer and designer. Material selection for the outer frame may vary from place to place and as per requirement.

tackle the current situation. It will also make us prepared for the future out comings.

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V. ADPATATION IN INDIA

The current safe houses in India are typically produced using materials like material, canvases, plastic sheeting, tin sheets, and so on giving cheap impermanent sanctuary at insignificant expense. Be that as it may, textures will in general spoil material and plastic both deteriorate upon openness to water and UV beams. Tin structures additionally demonstrate deficient with their negligible insurance from the components. Moreover, these tin structures are in the condition of going on for an exceptionally restricted measure of time subsequently the actual vurnability of individuals living inside is stressing.

Besides temporary housing, temporary and portable office space is a large segment which lends itself to FRP design. The growing infrastructure development and increasing number of projects in road building, construction, etc. will determine the demand for such office space, which is going to be enormous. Presently, some of this demand is met by container style boxes manufactured in steel, which makes them heavy and not so portable.

The utilization of secluded structural ideas can assist with meeting the above challenges viably by planning separate segments that could be associated together in a foreordained way. The quality of a secluded framework is that any one module can be supplanted or added/eliminated/subbed without influencing the remainder of the framework from the original submission for page layout reasons. This includes the possibility that some in-line equations will be made display equations to create better flow in a paragraph. If display equations do not fit in the two-column format, they will also be reformatted. Authors are strongly encouraged to ensure that equations fit in the given column width.

VI. CONCLUSION

The experience of the Leishenshan Hospital project can be used as an important reference for other countries that are still facing the threat of COVID-19. Future studies are expected to provide more cases for investigating the use of modular structures, as well as advanced information technologies, to strengthen public health systems under emergency conditions. From the above work it can be expected that at the end of the project we will have an isolation compartment for the people to isolate. The compartment will have 4 four beds, divide into two different sections. Inside the compartment all guidelines which are required to be followed for isolation will be followed. The whole structure will be checked for static and dynamic forces. Thus it is expected it will carry all the forces which will act upon it. It is also expected to boost this technique not only in field of medical but also in other fields of emergency. By designing such structures we might be able to